

THE SURVIVOR

Volume 7

By Kurt Saxon



FIG. 47.—Boat with bow.

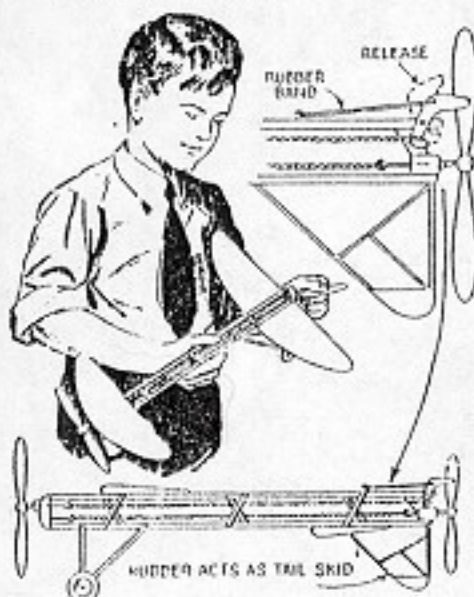


FIG. 48.—Boat with bow.

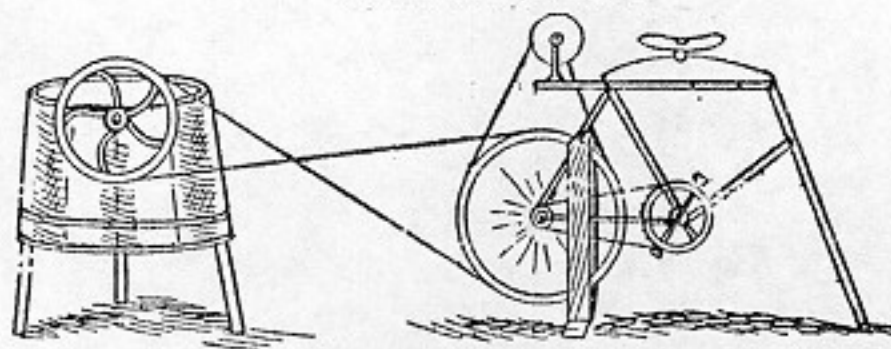


FIG. 49.—Boat with bow.

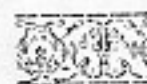
Twin Propellers Double Flight Time of This Model Plane



A COUNTRY STORE



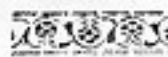
PEDAL POWER DEVICE



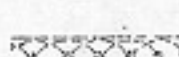
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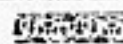
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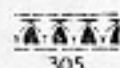
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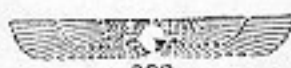
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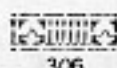
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305



300



306



FIG. 43.—Knot.



FIG. 44.—Knot (tying).



JUST A FEW OF THE ARTICLES IN VOLUME 7

CAPPY DICK'S FUN FOR BOYS AND GIRLS 1942

STENCILS, A COMPLETE COMMERCIAL COURSE 1941

KNOTS, SPLICES & ROPEWORK 1917

BASIC WOODWORKING PROCESSES 1935

HANDY FARM DEVICES 1910

ROOT ROT

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SCIENCE

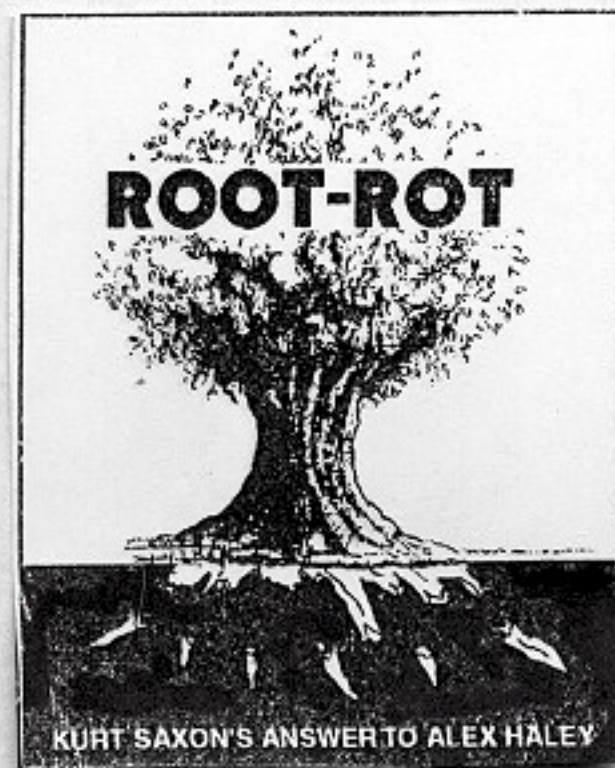
CRAFTS

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PLAYGROUND EQUIPMENT



KURT SAXON'S ANSWER TO ALEX HALEY

THE SURVIVOR

Volume 7

By Kurt Saxon

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how to make a proper bagel

SUNSET SEPTEMBER 1963

In that brief purple period when San Francisco was considered a center of the Beat Generation, one of the beat hangouts in the city's North Beach district was the Coexistence Bagel Shop.

Now there's nothing particularly beat about bagels. But coexistence is something they decidedly deserve.

Bagels are doughnut-shaped rolls, made with a yeast dough much like bread, but prepared and cooked in a special way to give them their distinct, resilient texture, chewiness, and good, wheaty, homemade bread flavor. The perfect, polished bagels from a specialty baker are very good indeed, but some say you just haven't eaten a proper bagel if you have never tried a homemade water bagel hot from the oven and lavishly spread with butter.

Murray Falkin, born and bred in Brooklyn but now a convert to Pacific Northwest living in Seattle, makes bagels for his family. This is his favorite recipe for water bagels, tested and tried over many years.

MURRAY'S WATER BAGELS

- 1 package dry yeast
- 1 1/2 cups water
- 3 teaspoons salt
- 3 tablespoons sugar
- 6 cups sifted flour

Dissolve yeast in water, which should be at room temperature. Add salt and sugar and stir until dissolved. Add flour. Knead dough on lightly floured board for 10 minutes. Let rise in greased bowl for 15 minutes.

Punch flat and form square of dough about 1 inch thick. Use a sharp knife to cut into 12 equal strips. Roll each strip between the fingers until it is about 1/2 inch in diameter. Join ends to form into doughnut shape by either of two methods:

HOW LONG DO WE HAVE?

by Kurt Saxon

In 1850, for the first time in history, the human population reached one billion. It had taken thousands, perhaps millions of years for men to develop food production, medicine and industry to the point where the species could multiply unchecked. And multiply they did.

In only 80 years from the billion point, 1930 marked another doubling to two billion. In 45 more years the population doubled again to four billion in 1975. In the past 13 years the population has jumped to over a billion more. Those who study population growth predict that by the year 2000, only 12 years from the five billion point, the population will double again to ten billion.

This is unlikely, however. Imagine you weighed 500 hundred pounds. Your doctor predicts that if you continue to gain at your present rate, you will weigh 1,000 pounds in time. You can barely function now and your body's systems will break down long before you reach that awful figure.

Today, nearly every system on Earth is strained to the breaking point. North Africa is dying, India with a million homeless families living on the streets of Calcutta, has no reserves left. The Philippines have five times the population of 50 years ago.

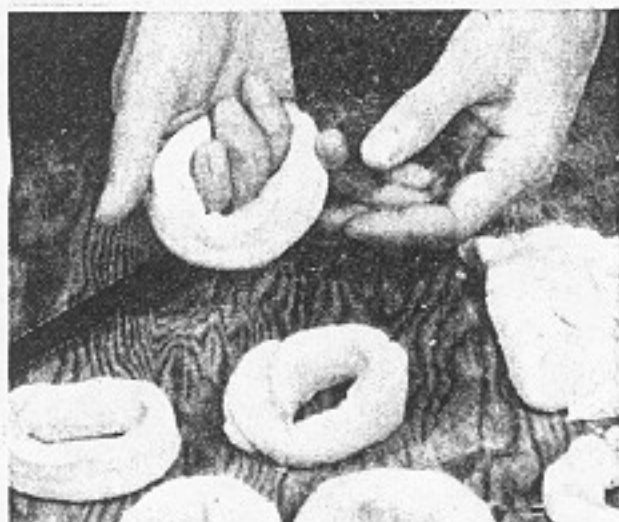
The reefs around the Philippines are being destroyed at an alarming rate as the people dynamite them or pound them to rubble while herding fish into huge nets. As much as 70% of the reefs have been damaged as the wretched islanders continue to destroy their country's ocean ecology for a little more protein.

South America and Mexico are in desperate straits. Even Russia has homeless and unemployed living in Moscow's bus and train terminals. America has millions of homeless and one out of five American children goes to bed hungry each night. No, the world's population will not grow to ten billion.

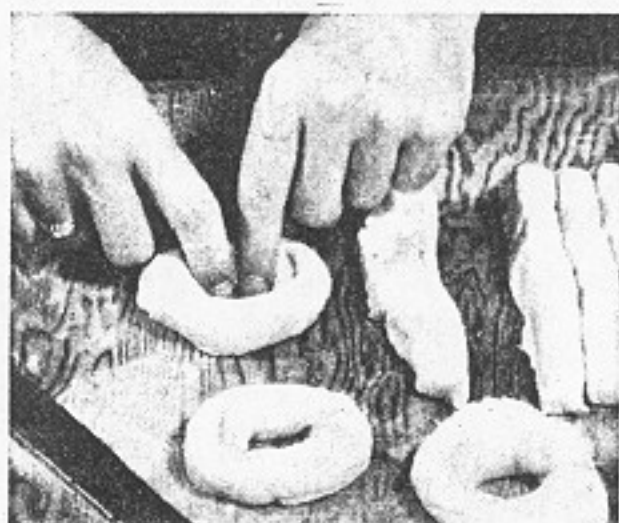
The latest and worst threat to Earth's population is the "Greenhouse Effect". This is simply the growing layer of carbon dioxide and other pollutants poured into the upper air over the past

Wrap loosely around three fingers, overlap ends a little, and squeeze together; or form on board by overlapping ends and squeezing together with thumb and forefinger. Work each into uniform shape. Cover all with a towel and let rise 20 minutes.

Place 1 gallon of water in a deep pot, add 1 tablespoon sugar, and bring to a boil. Keep water just under the boiling point and add bagels one at a time; cook 4 or 5 at once. They will sink, then come to the top. Simmer each one for 7 minutes,



One way to form a bagel: Wrap dough strip around fingers; overlap the ends; squeeze



Another way: Lay strip on board; overlap ends; squeeze with thumb and forefinger



In hot water, bagels sink and then rise to the top. After 7 minutes, rescue with fork

decades and accelerating as industry provides for more consumers.

For the past few years, ecologists have been warning of the Greenhouse Effect. But the phenomenon was understood long ago. In the August, 1931 Popular Mechanics was a short article:

DOES EARTH FACE A WARM AGE AS RESULT OF INDUSTRY?

Earth, according to geologists, is getting warmer. And its recovery from the last ice age may be speeded up a little by the increasing combustion of coal in the furnaces of factories and homes. Burning coal releases carbon dioxide into the air and it is believed that the increase or decrease of carbon dioxide has much to do with changes in the average temperature of the earth's surface. Studies in the U. S. naval research laboratory have shown that the average temperature may be raised ten degrees by doubling the amount of carbon dioxide in the air. To do this, however, would require the burning of 1,000 tons of coal for every person in the world. While the total present coal consumption is less than one ton a year for every person, it is considered that the effect of releasing even that much carbon dioxide into the air may be a slight increase in temperature.

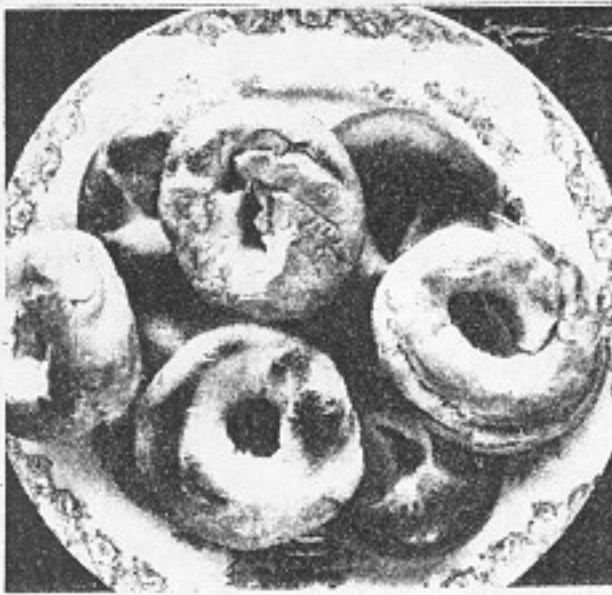
West Germany alone dumps 20 million tons of carbon dioxide and other pollutants into the air each year. Add the pollution of Detroit, Chicago, Los Angeles and all the other industry-oriented metropolises, plus the huge jets, hundreds of millions of cars, etc., you can imagine the blanket of pollution enveloping our planet.

Another factor in the amount of carbon dioxide in the upper air is the decreasing plant life. Plants absorb carbon dioxide and release oxygen. But add carbon monoxide, lead and other inorganic pollutants to the carbon dioxide and the plants die.

Germany's industrial and vehicular pollutants are killing the Black Forest. California's once magnificent forests are dying from smog. Along every highway on Earth, roadside plants are being killed by vehicular pollutants. Acid rains from U.S. industries are not only killing their own surrounding vegetation but destroying the fish and plant life in Canada's lakes, as well as killing the fish and algae in our own Great Lakes.

The North Sea, in which are England's oil pumping platforms, is dying. Pollutants from industries all over the planet are being pumped into every river, lake and ocean, killing more algae.

Algae, tiny one-celled plants, absorb more carbon dioxide and give off more oxygen than all the vegetation on the land. As the planet's water is polluted and more algae die, plus deforestation



After oven baking, bagels have doughnut shape but otherwise look like hard rolls

remove from water with a fork, and place uncovered on a towel to cool.

Place on ungreased baking sheet, not touching. Bake in medium oven (375°) for 30 to 35 minutes, or until they are brown. Makes 12 bagels about 4 inches in diameter.

If you can't eat them right from the baking, they may be warmed in foil, split and toasted, or eaten cold. Slice them crosswise to use for sandwiches and then fill with thin corned beef slices, pastrami, or tuna salad. Or eat them the classic way: with cream cheese and lox (lightly smoked salmon).

Murray Falkin
Seattle

Cleaning Old Paint Brushes

Old paint brushes, which have been allowed to become stiff or caked with paint to such an extent that turpentine does not loosen the bristles, can be softened in the following way: Take a package of any of the well-known brands of powdered soap and make a very thin paste, using cold water. Let the brushes soak in this paste until they are soft. Any brushes worth saving at all will come out clean and pliable.

How to Make a Toy Steam Engine

Popular Mechanics -- 1913

A toy engine can be easily made from old implements which can be found in nearly every house.

The cylinder A, Fig. 1, is an old bicycle pump, cut in half. The steam chest D, is part of the piston tube of the same pump, the other parts being used for the bearing B, and the crank bearing C. The flywheel Q can be any small-sized iron wheel; either an old

and desertification, less carbon dioxide will be absorbed and less oxygen will be released. The excess of carbon dioxide and lessening of oxygen is choking the planet and its people.

And choke it does. In a city's atmosphere it takes the place of a higher percentage of oxygen than ever before. This makes the lungs work harder and generally overtaxes the system.

Aside from the maniacal destruction of ocean life, consider the deliberate razing of our forests. At least one acre of forest is cut down every second, adding up to over 80,000 acres each and every day! Our planet's deserts are being expanded at the rate of 27,000 square miles per year.

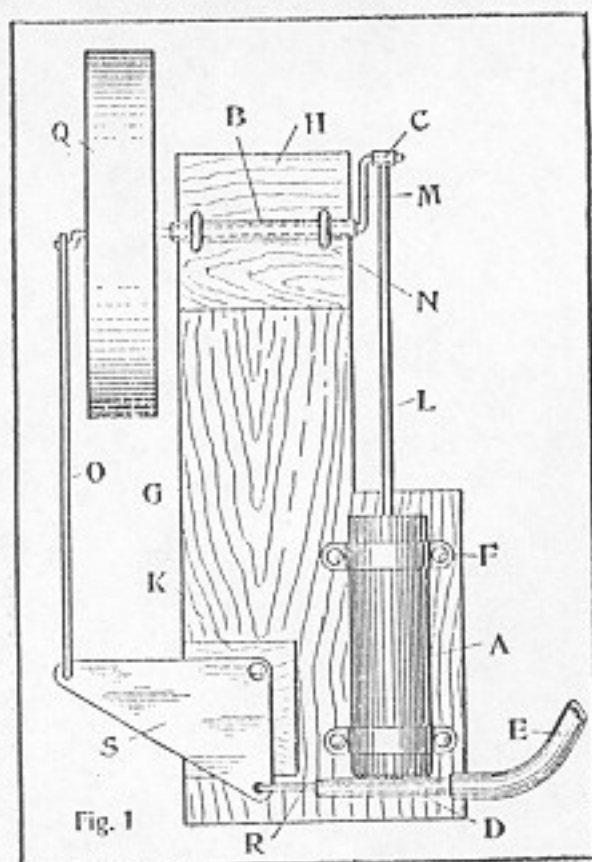
Still another factor threatening mankind is the drouth. The so-called drouth in North Africa is the result of overgrazing the grasslands and cutting down the trees for fuel. The North Africans have actually turned their territory into a desert which does not produce enough water vapor to rise and descend as rain.

A real drouth, however, as we are experiencing now, could kill vegetation to the point where there would not be enough water vapor released into the upper air to form rain clouds. Our drouth could lead to the desertification of the Great Plains and the Mid-West. These areas are the greatest producers of wheat, corn and soybeans, not to mention rice, hay and beef. So even after the collapse of world civilization and an attendant lessening of the Greenhouse Effect, Middle America could be left as permanently dry as the Sahara.

Few people understand the mechanics of the Greenhouse Effect. What happens is that, as the layer of pollution in the upper air thickens, the sun's heat gets in but is stopped from getting back out. It's as if you covered yourself with a blanket and stood out in the sun. There would soon be a lot more heat under the blanket than outside. The inner heat would not be able to get out and as outer heat penetrated through the blanket the inner heat would build up to critical.

This initial stage of our drouth is caused by the heat, evaporating the water from plants, lakes and rivers. You may wonder what happens to the water vapor that goes up. It has to come down somewhere. It does, but as heat builds up under the pollution layer, it breaks down and separates the water molecules so they cannot get together to form rain clouds. In some cases, what rain falls evaporates before it hits the ground or at least falls too scantily to do much good.

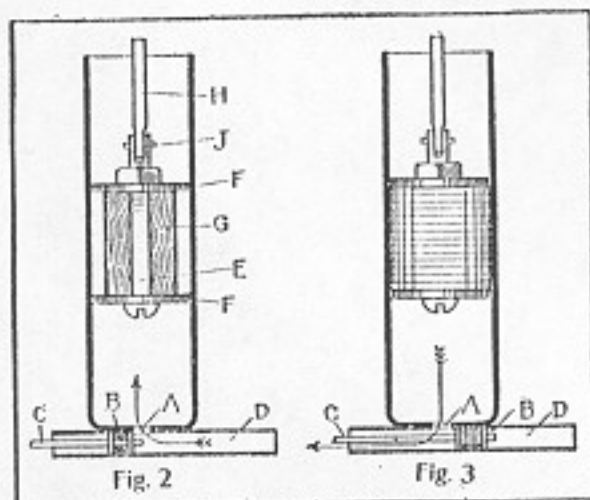
This is especially so because the ground is so hot it repels the moisture. So the water vapor goes along, bouncing off the hot surface until the prevailing winds take it over a cooler surface. As the water vapor gets to the cool ocean the water molecules are able to unite and form rain clouds. So in times of drouth there is still plenty of rain, but only over the oceans and coasts.



Toy Steam Engine Assembled

sewing-machine wheel, pulley wheel, or anything available. We used a wheel from an old high chair for our engine. If the bore in the wheel is too large for the shaft, it may be bushed with a piece of hard wood. The shaft is made of heavy steel wire, the size of the hole in the bearing B.

The base is made of wood, and has two wood blocks, H and K, $\frac{3}{8}$ in. thick,



Valve Motion and Construction of Piston

to support bearing B, and valve crank S, which is made of tin. The hose E connects to the boiler, which will be described later. The clips F F are soldered to the cylinder and nailed to the base, and the bearing B is fastened by staples.

The valve motion is shown in Figs. 2 and 3. In Fig. 2 the steam is entering the cylinder, and in Fig. 3 the valve B has closed the steam inlet and opened the exhaust, thus allowing the steam in the cylinder to escape.

The piston is made of a stove bolt,

With so much less rain in the interior the rivers, and especially the Mississippi, are drying up. There were suggestions that the Lake Michigan locks should be opened up so as to release enough water to float the stalled barges on the Mississippi. The people around Lake Michigan and the other lakes, which would be lowered by such a move protested. They said the levels of the Great Lakes were low enough, thank you.

Now there are reports that the Gulf of Mexico is beginning to flow up the Mississippi. This is because the level of the Mississippi is 25 feet below normal, which makes the Gulf level higher. There are fears that a greater influx of Gulf salt water will replace the drinking water taken from the Mississippi.

So by now you've heard on TV the opinions of meteorologists, ecologists and any number of burnt-out farmers who admit something is dreadfully wrong with the weather. The warming trend is both permanent and progressive.

There are no solutions; political, social, economic or otherwise. Even if everyone were of the same race, religion, party, etc., the game of huddled masses is over. The planet will soon be treated to a culling far beyond the imaginings of even the most pessimistic.

As the drouth progresses, those anticipating a nuclear winter in the event of war might begin to welcome one. If they are right, the nuclear winter might cancel out the terminal drouth.

So how much time do we have? Who knows? But you must realize that our plundered planet will not reach a population density of ten billion. And what with all the man-made disasters threatening mankind, I believe five years grace would be the maximum any rational person could bet on.

But are you just to give up and die? I think not. Civilizations have been rising and falling for thousands of years. Some far-sighted, enterprising people always survive whatever took the rest. So why shouldn't you prevail?

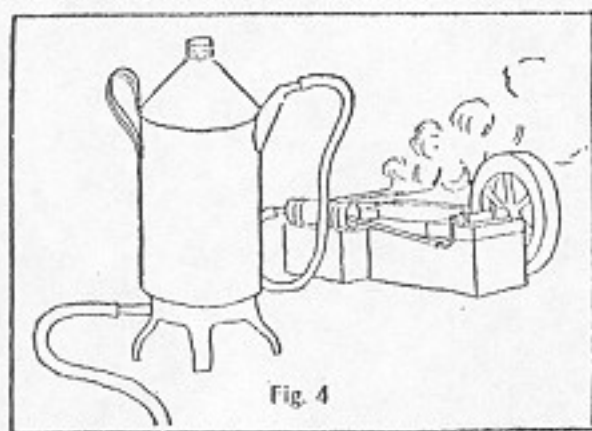
If you consider yourself worthy to continue our species, you probably are. But there are a few rules you must follow. You must plan to be in an area of low population density. You must collect works on self-sufficiency in order to be needed by those around you and, most important, you must consider your neighbors your best survival assets.

Too many survivalists seem to have the backpack mentality and think they can rough it like 18th Century mountain men. That is a fun fantasy but hardly practical when you envision a hundred Daniel Boones after the same deer.

Instead of competing for scarce game you should study small greenhouse and other methods of limited food production. You should plan to cooperate with neighbors in helping as many good people through the approaching hard times as possible. A program based on 19th and early 20th Century tech-

E, Fig. 2, with two washers, F F, and a cylindrical piece of hard wood, G. This is wound with soft string, as shown in Fig. 3, and saturated with thick oil. A slot is cut in the end of the bolt E, to receive the connecting rod H. The valve B is made of an old bicycle spoke, C, with the nut cut in half and filed down as shown, the space between the two halves being filled with string and oiled.

The valve crank S, Fig. 1, is cut out of tin, or galvanized iron, and is moved



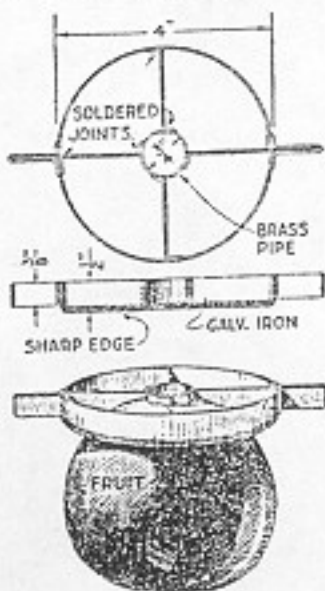
Engine in Operation

by a small crank on the shaft. This crank should be at right angles to the main crank.

The boiler, Fig. 4, can be an old oil can, powder can, or a syrup can with a tube soldered to it, and is connected to the engine by a piece of rubber tubing. The heat from a small gas stove will furnish steam fast enough to run the engine at high speed.

Device Quarters and Cores Apples and Other Fruit Popular Mechanics — 1919

To provide a simple homemade device for cutting apples and other fruit into quarters and at the same time removing the core, the arrangement shown in the sketch was made. The circular frame is built up around a ring, $\frac{3}{4}$ in. in diameter, and the ribs and handles are soldered to it. A strip of galvanized iron, $\frac{1}{2}$ in. wide, was used for the cutting portion, and the lower edge was filed sharp, and then finished with a small oil stone. In use, the cutter is set over the fruit, as shown, and by pressure on the handles, it is cut neatly.



nology (low-tech) would be the most viable.

The literature of those days was written for lay people, as opposed to professionals. This was because education was not universal. It was not expected that one had any background in a field to want to learn its principles. So if you can read you can understand most early descriptions of technology.

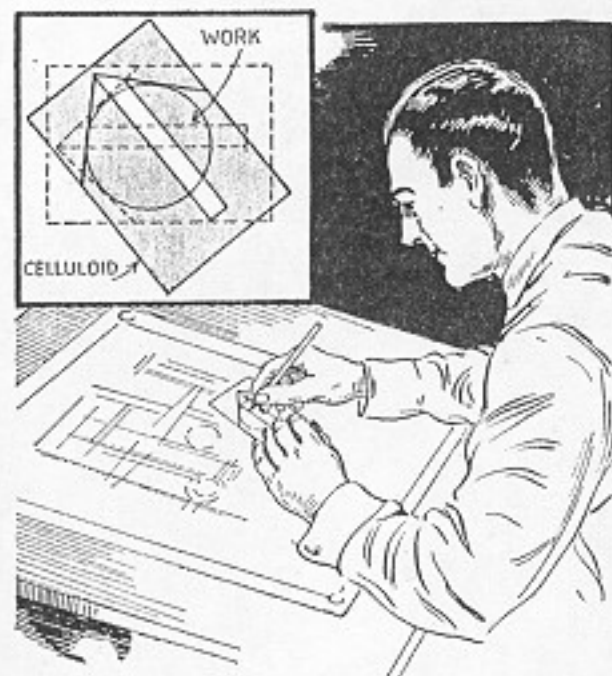
By choosing an easily understood cottage industry, patterned after the occupations familiar to your great-grandparents, you can support yourself and have enough surplus to barter with others.

Life will be difficult for some time. But with the willingness to apply yourself to the needs at hand, you and your neighbors can rebuild and even found dynasties.

Popular Mechanics March, 1937

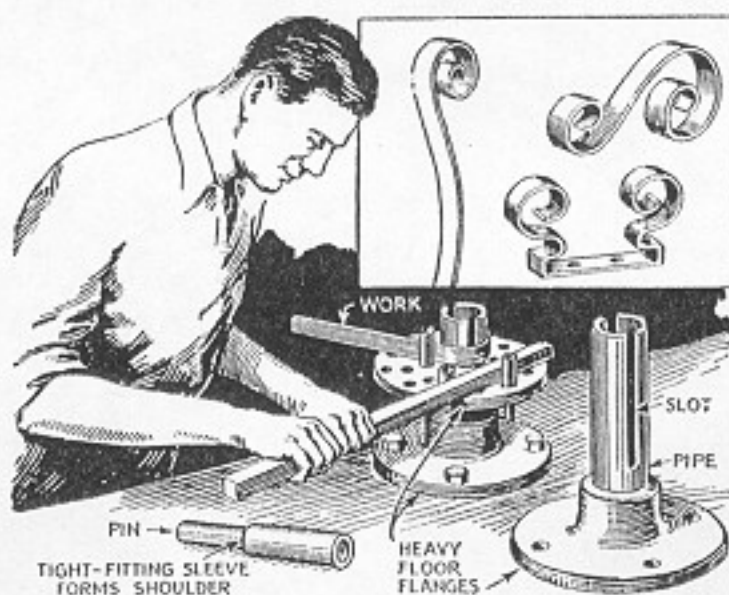
Finding the Center of Circles Without Rule or Compass

Finding the center of a circle is easy with this simple instrument. It consists of a rectangular sheet of thin, transparent celluloid on which is drawn a right angle in the position shown. Score the lines and ink them so that they are easily seen. Divide the angle in half, locating two 45° points. Then along a line drawn between the points, cut through the celluloid with a sharp knife, guiding it with a straight-edge. Make another cut parallel to the first and cut out the waste, leaving a slot about $\frac{1}{16}$ in. wide. In use, place the instrument over the circle with the right-angle lines tangent to the circle. Then draw a line across the circle, using the long side of the slot as a guide. Shift the instrument 90° , place it in the same relative position and draw a second line which will intersect the first one. The point of intersection is the center of the circle.



Popular Mechanics February, 1937

Iron Scrollwork Is Easily Bent on This Rigid Rotating Jig



Handling practically any bends necessary in making ornamental scrollwork, this inexpensive bending jig consists of two pipe flanges and a nipple. One flange is bolted to the bench and the nipple, which is slotted at the upper end, is screwed into it. The other flange is reamed to a snug, sliding fit over the nipple, and is drilled to take steel pins, which, in use, are set at various locations to form the desired bend when the flange is turned.

Indelible ink marks may be removed often by applying equal parts of turpentine and ammonia.

IN A COUNTRY STORE.



THE COUNTRY STORE.

IN A COUNTRY STORE.

HARPER'S MONTHLY

May 1870

A WAY from the cities the whole range of lesser everyday wants turns for fulfillment to the country store. And so it becomes a clustering-point for all of village life.

There is no limit to its possibilities. If Aunt Eunice wants any thing, from a wash-tub to an ounce of paregoric, she knows where to find it; but when she broke her only pair of spectacles, the other day, she came to us in doubt.

"You keep 'most every thing," she said, hopefully.

"Yes, I know; but we don't sell spectacles. People are so different, you see. But there are a pair or two about here somewhere, if they will do you any good."

These had come to us from some auction or other, where were congregated the quaint and useless relics of many a previous sale—relics that are still destined, I doubt not, for further kicks adown the vales of time by auctioneers yet unborn. I have them before me now—

stout-rimmed, cumbrous, brassy—staring owl-like at me, as if from out the deepening twilight of the past; the glasses so scratched and dim with use and age that it is easy to imagine that within their misty lenses lingers the remembrance of many a vanished scene, and that they feebly attempt, as I place them astride of my nose, to twist the familiar things at which I look into an antique picture which shall be in keeping with their own venerable aspect.

But they are spectacles. A rare spectacle, too, was the good woman's face as she held them afar, that she might the better inspect them with her crippled eyes.

"Goodness! Did you ever! How could people ever wear such things as these? I hope

you don't ever expect to sell 'em?"

But thus happily were the resources of our "establishment" vindicated; though really less ready we than that other shop-keeper of these parts, who laid a wager he could fill any single demand, and triumphantly produced a second-hand pulpit which was called for.

Such enterprising spirits are not narrowed by any study of the known laws of supply and demand. Within the precincts over which I have been called to exercise a temporary charge are gathered many things that have long failed to excite the appreciation of our plain country folks—patent medicines, powders and unguents, of happiest efficacy and ill-warrantable range of cure; polishing powders, enough to burnish the world until it should shine like another sun; preparations and contrivances needing a second inventor to discover a use for them or to tell their efficiency—and which are here awaiting in dingy and fly-specked state that happy millennial time which shall find for all inexplicable and slighted things a full and legitimate use.

The country store-keeper is in some sort a public character. He finds himself used in a dozen different ways—as banker, oracle, referee, newspaper, directory, intelligence man, etc.—almost before he is aware. Gossip and small-talk he should retail with the same graceful alacrity with which he dispenses maccaboy and peppermint drops. Thoroughly democratic as an institution, "the store" recognizes no caste, and its door swings freely open to all who come, whatever be their errands. An inviting haunt for all the idle ones among us, its fireside on stormy or impracticable days draws together its little circle, that is ever shifting its character and its subjects as different persons come and go. Sometimes the conversation has all the interest that native humor and penetration can give it. But not unfrequently will it subside into the veriest twaddle. Few and almost commonplace as are the occurrences of

rural life, yet the social requirements of the village demand that these be made the most of, that no one may be guilty of so indecorous a thing as silence in his neighbor's presence. A meagre subject soon gets worn distressingly thin by this rapid process of tongues, and he before whom the ascendant topics rehearse themselves more frequently than any other, may find himself growing strangely indifferent at times. The unusual weather will fail to inspire him, and he is, perchance, unfascinated even by the recent mishap to Mr. Wiggins's cow. Strange, that of all the persons coming hither, and feeling themselves in duty bound to chat about something, so few should leave behind them any thing really worth remembering. I once heard a witty person say, "Never talk unless you say something;" and I have at times entertained the desperate thought of emblazoning his words above our store. But then we have some visitors whom I would not silence for the world.

Perhaps a more buoyant and self-sacrificing



AUNT EUNICE.

nature, by giving his days and his nights to the study, might at last infuse his frequent audience with something of the universal spirit of culture and vivacity which he imagines they at present lack. Humbly I say this, as one conscious of his own unworthiness. But, happily, if to me have been manifested those instincts of the people which point out the "Coming Man" who is to supply satisfactorily all their wants over the counter of a country store. Whether that unfortunate individual is to be shut off from his high destiny by the co-operative system, is a question from which I stand tremblingly aloof.

As I have intimated, the store-keeper can not be in the least exclusive. He is one of those felicitous individuals whom "every body" knows. But especially is his character made a study by that omnipresent class of married vagabonds who quarter themselves transiently upon the village, stepping, as it were, into the still warm tracks of a dozen vanished predecessors. These pursue their investigations with such astonishing acumen and success, that before the year of their lease has flown, they ascertain to a cent how far they can insinuate themselves into his books. But even then their continued faith in his good-nature is something wonderful. Ever doubtful of their own conclusions, they look for softer moods in the shopman, as we look for bland days in late autumn, that they may bask a little longer in the sunshine of his confidence.

If he be of a philosophic temper, the dealer comes at last to look upon this accommodating trust of his in the honesty and solvency of all mankind as a sort of involuntary beneficence, almost sublime in its extent and the uncertainty that surrounds it. It is a cardinal principle of the social economy of the dealer whom I serve that the provident man gathers not alone for himself, but for the benefit of all about him; so, considering himself one of the stewards of this world, he is often swindled in the most obliging of spirits—perhaps with a smile upon his face, and an after-hope springing up in his heart of treasure laid up somewhere.

But I trust I have not conveyed the idea that these unthrifty ones practice deliberately upon the grocer's good-nature. Of course they expect to pay for all they get; they surely will when comes that grand gush of good fortune for which they are ever lying in wait.

The reverse of this picture—must I say it?—is not all sunshine. Thrift is admirable—essential; but it has some mean relations, and he who deals much with the public soon comes to know the whole clan. Some are forever questioning his weights, his prices, his figures, and his books. Their economy, and by that same token, I am afraid, their conscience too, knows no honest man. But shabbiest of all this penurious tribe are those well-to-do persons who must always be served at less than the standard prices, or they will not buy at all; and those others who always fall a little short of the exact amount of their bill. I wonder if that good woman, who always insists that I shall throw off a few cents from each article of her purchase, knows how she is tempting me to stilt my prices up for her especial benefit? and that bland individual, who will never hand me the five cents that is due, will he weigh his package when he gets home, to see if I am honest as he is? It might be well to think of these things; more is involved than is at first apparent. One pays, sometimes, too egregious a price even for

prosperity.

The store-keeper is also the victim of numerous tricks, and all the popular jokes and "sells" are tried upon him. These things are endowed with a surprising longevity, and there is a certain periodicity about their recurrence which is really curious. When every body has apparently forgotten them, and they might be supposed to be decently mouldering in their graves, they suddenly spring out before you, like "Jack-in-a-box," and take you by the nose, screaming, "Ha, ha! you had quite forgotten what rare jokes we are!" and resume, in fleshless jollity, their wanderings about the world.

A small head comes through the door:

"Has Bob been here?"

"Bob who?"

"Thingumbob!" And the ghost scampers away, dragging the tickled boy after it to other posthumous successes.

"How short these cigars are!" remarks a youth who is selecting one. "Don't you want them any longer?" and he begins to roll them on the counter, as if to lengthen them.

"No, no! we don't want them any longer."

"Very well," says he, grinning, "if you don't, I'll take them away."

Bah! Puns are execrable, and this one should have been buried long ago.

"How do you sell those corn-poppers?" questions a droll one.

"Twenty-five cents."

"Got any penny ones?" he asks, innocently.

In the days of specie, enterprising lads were wont to drop large cents into the till, and then insist, by a happy process of reasoning that was all their own, that they were "quarters." Indeed, the shopman is considered fair game by this class for all sorts of little schemes; and it is certainly no fault of theirs that his life does not beget a fell suspicion of all his race.

But in spite of all the ill-natured things I have felt called to say, my position is not without its pleasant aspects. It is flattering to that busy spirit that possesses so completely most of our nation to be enabled to be so generally useful in supplying the substantial wants of one's neighbors. And whatever of unhackneyed interest or picturesqueness there is in village life will, in due time, reveal itself to us who meet our neighbors oftener than does any other.

The following is from the notes of a single day:

This morning I let down the heavy, old-fashioned shutters upon the supporting posts outside, and kindle a fire, for this is wintry weather. Then I sweep the dirt from the floor. There is a deal of suggestion in it. With nut-shells, orange-peel, and the like, scattered about, how like it is to the ashes of yesterday's life! These cardamoms that skip away from my broom were dropped by pretty Nellie L—, in her surprise that clumsy, boyish Giles should thrust them into her hand, as she was matching sewing-silks at the counter. "Them are yours," he blurted, hastily, and then ran, half-frightened, away. "Old Horace" spilled these crackers from out the wrecked bundle under his arm, as he stopped, on his homeward way, last night; and this candy, ground and trodden about the floor, was lost by "Baby" Lane, who came hither alone yesterday, in eager haste to spend the rare cent she had got. Two school-boys were playfully scuffling at the time, and I had just bidden them to cease, when,

as Baby turned timidly from the counter, they dashed against her, and she fell. Away from out her hurt little hand flew her precious purchase, and a heavy heel came down upon it and ground it to hopeless atoms. Poor Baby! It would indeed have been worth crying about had restitution been impossible. But Baby was finally righted, and I hope she will not remember the cent's worth of candy she carried home at last as a criterion of all her future purchases.

My first visitor this morning is an ambitious school-boy. He lives near by, and is in haste to buy a pencil, which he begs me to sharpen—"Quick; so I can do my sums before school." It is very pleasant to possess the friendship of those budding potentates—the boys. It is sound policy, too, for us whose business calls us much before the public, as those best know who have once incurred their displeasure. How shrewdly they provoke their obnoxious victim, till in some luckless moment he betrays his weakest point, and then how mercilessly do they assail him at it! And he who, in his wrath, attempts to resent their clamorous persecutions will prove himself very impotent and very unwise. Mr. Jingle, speculator in "junk," rags, and iron, was driven from town by them only a few months ago, because he did not take their overtures kindly. They found that he was above his business. Little pleasantries



THE STRANDED DEUMMED-BOY.

about the price of old iron and the condition of the bone market galled him, and he resented them. Soon it was no longer, "Mr. Jingle, what is the price of old iron now?" but, "Old Jingle! old Junkee! old Bones! Do you get any good soup-pieces now?" and a deal of similar stuff, flung after him from a secure distance. He was also the subject of many ingeniously-hidcous serenades, and one night his bell-pull was twitched violently out, and his fence torn down. Many of us pitied the man; but that did not help his case. He tried the law, but got no permanent redress, and at last he shook the dust from off his feet, and departed from our borders forever.

Hastening thus early to our fireside comes a homeless vagrant, chilled and purple with cold, having passed the night, as he has every other since winter closed in, in a comfortless haymow

somewhere in the neighborhood. Veriest of loafers and most unambitious of youths is he. Life makes no such large promises to him as it does to most young men just approaching their majority. Things might have been different, he said to me one day, if he had improved certain earlier opportunities; but he now folds his hands, as if satisfied that the time for all hopeful effort were past. Work and board have been offered him; but, as these would remove him from his present haunts, to which he has a sort of animal attachment, he seems to think the very proposal an annoyance, his present life answering all his demands, or he now feeling himself incapable of living any other. How he manages to eke out a subsistence is a standing wonder to our good people, as he seldom earns any thing, and there is little about at this season that he could steal, had he a thievish propensity. I sometimes think he could give some suggestive facts to social economists if he would, as he always appears in full bodily condition. What egregious fools he might prove most of us to be, for bartering all our lives away for an insignificant living! But his pride makes him miss even this whimsical chance of being of use to us in any way; for he is not that merry, captivating vagabond who makes a jest of his poverty, and by his light-hearted philosophy compensates the world for his idleness, but one who would gladly have been other than he is, had circumstances, without asking too much effort from him, made it possible.

We of this busy nation are at a loss to understand that predicament of mind which allows a man in rags, and perhaps with dull hunger gnawing him within, to sit inertly down amidst the whispers and sidelong looks of so many thrifty ones, and put forth no sturdy effort to better his condition. So he gets little sympathy, and it is his own dim, passive perception of the pity and contempt he excites that makes the aspect of his case more pathetic.

I think it was his life as a drummer-boy in the army that confirmed his habits of indolence and improvidence so strongly upon him. Since the quarter-master and cook were discharged, he has drifted helplessly away from whatever locality he may call home—sinking, meanwhile, in the scale of public opinion, from the proud rank of the disbanded hero to the lower depths of worthless vagabondage—and has at last stranded in the placid waters of our village life.

For weeks he has come to our fireside as punctually as the week-day mornings, generally remaining the whole day through, until the shutters close at night. There is a deal of tolerance in these degenerate days, or he would have been driven out of doors long ago. Poor devil! that inane pride of his, which must be to him an inexpressibly dreary and burdensome possession, might let him freeze before it would disclose his extremity; and so he is allowed to stay with us, who seldom close our doors against any, or exact explanations from those who come.

I answer his morning greeting with a reluctance I can not conceal, but which he seems not to notice, finding resentment impossible. As he warms himself he talks about indifferent things with a shivering attempt at vivacity, as if to persuade me that he is not the vapid and everlasting nuisance I have taken him to be, but is, on the contrary, a most lively and interesting person, whose coming in on this par-

ticular morning is one of those rare and happy accidents of good fortune for which I ought to be sincerely grateful. But as he grows warmer his voice mellows to a prosy monotone, and after a little he becomes lulled, as it were, by my inattention and the warmth, into a drowsy silence. There he will sit for hours, doing nothing save stretching his hands occasionally toward the stove, thinking that by affecting he is not yet warm he can excuse his continuance



HORACE RISLEY.

here, though his face is fairly aglow with superfluous heat. At times during the day he will arouse a little, and take what part he may in the conversation going on around him. Perhaps the uncertain flow of his speech will dribble on my ear for some time after the other speakers are gone, as though he were talking in his dreams, for I do not always pretend to listen to him. Indeed, I am continually forgetting his presence in the occasional silence of the apartment and my own abstraction, and it will of a sudden obtrude itself upon my perception, as I glance around from where I sit, as though I had discovered an apparition sitting there. Sometimes he reads, and the sharp, infrequent rustle of his paper comes to me as startlingly as the quick scamper of rats in the ceiling. It has even seemed to me at times, as in the silence I have studied him, that his body was really soul-abandoned, and had become only a cumbrous sort of ghost, susceptible indeed of suffering and destitution, but foreign to the bright inspirations of happiness—a being incapable of filling any worthy place in the world, unfortunately, and so standing, wistful and phantom-like, without the pale of our utilitarian life. But he is of too sluggish a nature to be deeply depressed, and often appears unconcerned and contented enough; and, as I have said, even attempts to be sprightly at times, as though inspired by a sudden determination to convince himself and us that he is quite other than the spiritless and forlorn individual we have taken him to be.

Early customers come and go—plain people, whose wants are easily supplied. While I am busy with these, enters Old Crazy Hooting Horace Risley. I here string all his titles together, not because they are ever thus collectively made

use of in speaking to or of him, but for the reason that the popular mind has in these various appellations happily condensed his most salient characteristics. His names fit him better than his clothes; and, remembering them, a stranger seeking him in our village street would be prepared to recognize him at once. He is simple and odd, rather than crazy—a harmless, cheerful old man, talking low and brokenly to himself as he takes his bent form along the village street, leaning low on the wood-saw he usually carries, the long use of which as a staff has so sadly crooked his aged back. He has gruff, good-natured words for every one he meets, and none would think of answering him in other than a kindly way.

For a long time Horace occupied at night an old, dilapidated barn, where the storms roared at him through the cracks and openings, and the bold rats used to steal out and plunder his Sunday store of crackers and cheese. But the old ruin fell about his head one lusty night, and he has since found safer quarters in a newer structure. He has blankets to wrap himself in, but I suspect the cold gets at him sometimes these bitter nights, for he is too old for the life he leads. Wont to earn his living by sawing wood and doing other plain jobs about the neighborhood, he is still able to do somewhat for the kind friends he has made, though not adequate to any considerable task. Yet he does not go hungry away; he never has a doubt where to go for his breakfast; nor are his other meals often wanting, or the bundle of crackers and cheese of a Saturday night for Sunday's quiet demands. A great gourmand, he delights to tell, with many a fond, unctuous grimace, what hearty dishes he affects, and how richly he has fed.

But as he enters the store this morning he greets me with a voice that is so hoarse and clogged with phlegm that it seems as if the words must terribly rasp his throat. Drawing a chair close to the stove, he drops his leathern mittens upon the floor, and his battered hat beside them—uncovering his wonderfully thick and silvery hair, a perfect "crown of glory" with the sunshine streaming over it—and stretching his numb and trembling hands about the stove, seems to take to himself great handfuls of the heat. Evidently he has had a cold walk, and perhaps did not sleep warmly last night. His cheeks are pinched to redness by the frost, and his thin, aged beard is tangled with icicles. Yet there is no bitterness in his heart, though he complains that the selectmen have neglected his requests for warmer clothing.

See! even while his complaints are troubling my comfort he falls to dozing beside the stove, and all the cold world, that so lately pinched him, drifts from his memory, and his senses sink as softly as a child's beneath the dreamy waves of sleep. Aroused by the noisy entrance of some school-boys, he gathers himself together, and after inviting himself to call again, in that quaint way he has of carrying on both sides of a conversation, goes off up the street, a prospective breakfast somewhere in the neighborhood luring him away from our fireside.

The homeless drummer-boy, whom we almost involuntarily expect will bow low his head to this life-worn veteran of his tribe, conducts himself toward him rather in an affectedly superior and patronizing way that is very surprising to observe. So it is that many lives are buoyed up and made altogether tolerable

by an innocent, out-at-the-elbows sort of content, which is ever thinking there are less fortunate conditions of life underlying its own.

But it will never do for an aspiring grocery clerk to keep his customers waiting so long. Among those who have come in is T—. He is not unlike his neighbors in many respects, yet is a droll and provoking genius in his way. He arrives at about the same conclusions as other men, but always by different processes of thought. His directness is sometimes startling. When he paid his tax to the collector, here in the store the other day, he said he was thus contracting with society that his life and property should not be molested by any of its members. "I don't feel the need of any of the cumbrous machinery of government to keep me a good neighbor," he remarked; "but as my fellow-men seem to—why, I am willing to help support their conservators." And he beamed pityingly around upon us all, a broad grin flickering just beneath the serious aspect of his face. This forenoon he has come for some nails to mend his hog-pen. As I do them up (T— says, "Never mind about a string") he discourses about his pig:

"He's an aspiring chap—this grunting brother of mine. It is difficult to confine him to a dead-level existence. This morning, having attained the freedom of the yard, he chewed up my newspaper for the paste that was on the wrapper. I am quite curious to observe what effect so sudden a digest of the affairs of the world will have upon his erratic genius."

Having lately picked up a vague idea of the principles of Darwinism, T— has lent himself ardently to that study ever since. He has found a wondering and attentive audience here.

"Strange I never thought of these things before," he says. "Why, I have the instincts of all grades of life centred in myself, I believe. I love molasses like a fly, the spring sunshine like a turtle, and chestnuts like a squirrel. I chew tobacco as the ox does his cud. Indeed, most of us have a good deal of the bovine lingering in us yet. We don't eat grass, to be sure, but the cattle do, and we eat them, getting our grass at second hand so. Now, in chewing tobacco," says he, waxing profound: "There you see a remembrance of the worm or grasshopper life that feeds wholly on it; then the ox habit, chewing; and perhaps back of all this lies the forgotten fact that we were once tobacco ourselves!" With a sly look at me he goes away, his audience, so soon as they can recover themselves from the puzzling labyrinths of their being in which he has involved them, laughing loudly after him—all except one, a knowing little man with snapping eyes. He has been whittling, in a rapt way, the barrel-head upon which he sits, and now raises his head with spasmodic suddenness.

"T— ain't any body's fool," he ejaculates, half closing one sagacious eye.

Meantime I sell a codfish to a little Irish woman, who compliments me needlessly; a Jackson ball, an axe-helve, two quarts of beans, a Farmers' Almanac, a box of cinnamon, etc., etc., to others. Verily my life has the spice of variety.

During an absence of other visitors enters a wayfarer. Of a sharp and grizzly aspect, his face has the look of one who has long been searching for some good that he has not found. His rough wayside staff, its top smoothly pol-

ished by his hand, at once announces him a traveler. He carries it always with him, in his hand or under his arm, as he walks about the store, using it in such familiar and unconscious ways to help along his talk that it seems to have become an essential accessory to his person. No less do his faded and weather-worn clothes speak of an outdoor life. He has on so many coats that the outer one is buttoned with difficulty about him—having wrapped himself up against the elements as though his experience had taught him to expect from all things the bitterest that might be. A felon, in a big bundle on his thumb, affords him an acute text, from which he discourses with dismal readiness and assurance. But even while he is gratuitously insisting upon the ills of poverty—maintaining that honest labor means perpet-



THE DARWINIST.

ual indigence—he spends, of the twenty-one cents he is able to collect from the many receptacles about his person, fourteen for tobacco and seven for crackers and cheese—a proceeding that might unsettle an unfledged faith in his philosophy. But it is not unprofitable to study these unfortunate characters, whose lives have been such sad failures in regard to all we think necessary to the completeness of our own.

This man's talk reveals him an Irish Protestant, a man of more zeal than devoutness or education. Our institutions have by no means answered his expectations. Bringing to this country a keen remembrance of the social distinctions and sectarian hates that have in times past so embroiled his own unhappy land, and finding the same elements of contention intricately woven into our social life, he can argue none but ill results. Gently as he may, he tells me there will be clashings, war, separation. He can not understand that social differences are unavoidable; or how, as I try to explain, the fierce militant spirit of sect is slowly softening into the more Christian idea, that the tendency and practical aim of all religion should be to make men better neighbors and more peaceful citizens. The Pope of Rome Party, as he calls it, is to him the very incarnation of bigotry and crafty power. Those ignorant countrymen of his, who dig our railroads and sewers, are its abject slaves. "Before I would go and dig

with them, I would steal!" And as he reaches this climax of his indignation he turns suddenly and fiercely on me, as if to express the darning of his resolution. The freedmen, too, are a dark burden upon his mind; he has found them all too cheaply filling many of the choice places about our homes and farms.

This man's memory discloses no sunny spots to me. A whole category of evils—national, social, personal—he enumerates, with a glibness I have done little to encourage, and which hints of many previous rehearsals—all of which seem to have touched in some way his life or his imagination—he ever reasoning outward, as it were, from some sore point in his own history or condition. His poverty and philosophy have embittered and narrowed his life, instead of educating and consoling it, and while he has darkly brooded on his ills the sweetness of his life has passed unaccepted away. Probably the world has used him roughly, has wronged him, perhaps, and he, looking for requital, can see no other way than by a general breaking up of the present condition of things, and a total separation of the good that he affects from the bad that he has known.

Like many another weary, misguided soul, he can not see how the world can go on much longer without coming to some kind of settlement. I imagine it is this expectation that keeps him from becoming an altogether morose and desperate man. He is now on his way to some visionary township which he long ago idealized as capable of answering his life's demands, but which he has never yet been able to find. And so he trudges on, toward an ever-receding goal, the faint hope that lingers in him dwindling sadly away.



THE WAYFARER.

I hope this portentous philosopher may some day find an adequate listener. It occurs to me, oddly enough, just as he bids me an emphatic good-day, that this may be one of the objects of his journeyings, and that I have been a fresh disappointment to him.

The gongs in the adjacent city bellow noon,

dwelling long upon the sound and repeating it in many rival tones. School is out, and the mingled shouts of the released children sound through our closed doors like the wild, sudden clamor of the crows when disturbed by the woodside. Here they come!—girls and boys crowding in together; some to spend the pennies they have kept till now—kept in lingering contemplation of the whole magnificent range of sweets which thus seemed open to them, but from which they must at last choose so little; some to see what these will buy, and perhaps (oh, hopeful perhaps!) to get a small taste from the generous little hand; others for the mere sake of stopping at “the store,” and learning what they may of life so. I have unwittingly found my way to the favor of these little ones. In my inexperience I gave them unwonted cent’s-worths; and now when they make their momentous purchases they shrewdly choose those things upon whose value the confectioner has set no arbitrary limits. They make me guess at the quantity they shall have, the little



THE BUTT OF THE BOYS.

rogues! and, like native politicians, hold me close to my ruinous “record.”

One little boy says he should like to be a store-keeper, and his eye ranges along the shelves in fond and sweet imaginings.

They are very inquisitive, these children—eager to understand every thing—wonderfully willing to be educated; and we all have to turn teacher at times. It behooves us to act more cheerfully and wisely in this matter than many of us seem to think. These youngsters are all, alas! so fæcilely human.

The village, having dined, stirs abroad once more. Among our afternoon visitors is one of the town’s notabilities. A small, toddling, awry-eyed personage—weak of intellect and garrulous of tongue. His flippant and good-natured imbecility has gained him a notoriety that a brighter wit could not attain. Every body knows him, and most play upon him—some in a kindly spirit enough, but others roughly, abusing him in their wanton pride of intellect. Somewhat in years, he has thus be-

come a sort of heir-loom for all the mischievous ones among us; while the men have grown too sedate, the boys have learned to practice upon him, and so he has been tossed, all his life, a sentient plaything, from one generation to another. His half-furnished mind, becoming more and more uncertain as the years gather around him, affords a curious and, at times, a puzzling study. Gossipy and credulous, and given to weak exaggeration, he once afforded the smart ones of the neighborhood an excellent opportunity to exercise their ingenuity, and all sorts of absurd stories were set afloat through him, who sturdily believed them all. So flattered and played upon, he has at last lost the power to separate the false from the true, and his own most insipid dreams now float through his colorless mind with all the parade and satisfaction of verities.

Fortunately his mind has no cognizance of its own infirmity. Whatever differences he perceives between himself and other men his conceit hastens to bridge over, and he has become, in many outward aspirations and observances, absurdly like the rest of us. Special police to all the small boys of the neighborhood, a consequential doer of errands, and a faithful attendant upon all public occasions, he fancies himself quite an indispensable character.

This afternoon as he came in he was all swelling with fresh indignation, his loud threats of summary vengeance having come to us before he reached our door. Some sportive wretch had pulled his cap violently over his eyes, and snatched from his crammed pocket a number of old newspapers, throwing them over a fence, where he was at some trouble to recover them again. Having recited his troubles he forgets them for a while, and babbles of a certain hearse and sextonship that each to-morrow of a long succession of weeks was surely to put into his hands, but did not. Still he has as stubborn a confidence in the to-morrow now before him as though no other had ever been named by him. We may humor his conceit, or laugh and pass him by, as all do at last, but his story is ever fresh upon his lips.

But most welcome of all the visitors of the day is he who enters briskly now. A figure of jolly dimensions, a face florid and full, giving at first an impression that its owner seldom smiles—an impression that does not linger long in his presence. He is one of those rare persons who talk for the mere sake of entertaining, and who succeed. But, unfortunately for my purpose here, bare words are so small a part of his conversation that it can not be adequately written. Made up largely of local anecdotes, it is a succession of actual and pertinent illustrations. But it is not mere gossip we are listening to; Human Nature seems rehearsing itself before us in the most jocund of moods. In the glamour of his presence we look upon the broad, sunny surface of life, and it shifts and dances in the rich gleam of his humor till all the world seems about to go masquerading. Yet it is ever true to itself. Every body has become suddenly natural—that is all; and so we feel a fresher and more fraternal interest in them. There is always fun enough in the world, and all we dull ones need is some one to discover it to us that we may laugh; and his is a mind that occupies itself pre-eminently in discerning and reflecting whatever odd or amusing things occur in the life around him. And

then that wonderful memory of his, which the years have stored with all kinds of warm-hued and delicious remembrances, and whose mellow



THE WELCOME VISITOR.

treasures he delights, at times, to display before us!

For nearly an hour he has inspired and delighted the chance audience he has found about our stove on this dull winter afternoon; and while all sit with hungry ears and faces that have not yet composed themselves, he rises abruptly, and we suddenly find ourselves at the mercy of each other again. And now that I try to recall some of the many good things he has been telling us, I am surprised to find them changed to the prosiest facts beneath my touch. The wizard has withdrawn his spell.

School is out for the day now, and our precincts sustain another irruption of chattering children. Those from a distance do their errands quickly, or, having left their orders at morning or noon, take up their purchases and are nimbly away, on the alert for a ride home. One little girl has forgotten her errand, and, between her doubt and the fear that she will lose her ride home with a neighbor, gets helplessly confused.

“Oh dear! what was it?” Her forehead is all knotted with perplexity.

“Perhaps it’s chewin’ gum,” draws a funny fellow.

“Or pins?” says a little girl who is about to buy a cent’s worth, and has climbed upon the counter for that momentous purpose.

“Or oranges—maybe raisins?” suggests a little boy with a big mouth, following their lead, and trying to climb up too.

But I check them. Perhaps I can think for her. “Was it cheese? soda? tea?” Strangely enough, I only confuse her the more.

“No, no; not any of them. Do let me think! Oh dear! there goes Mr. Munsen, and now I must walk home.” This in submissive despair. But immediately brightening, as her eye catches a placard—“Oh, it’s matches! Be quick, and p’raps I c’n catch him now!” I throw out the package, make change, which she sweeps into the wrist of her mitten without taking it off her hand. Seizing the package she is off like the wind, with great flutter of garments. I hurry out after her and shout, “Mr. Mun-sen!” That benevolent man looks around, checks his horse, and adds another happy little heart to his load.

After a little I am alone, save for the presence of the stranded drummer-boy; and the quiet that pervades the village informs me that

the world is "taking tea."

As the twilight deepens within doors, stealing from out the dusky corners as though it had been lurking there all day long, Old Horace stops on his downward way to warm himself against his long walk. He has supped royally to-night, and is happy as a lord. We even persuade him to sing a little in the most unmusical and unintelligible of voices. His laugh is hearty and cheerful as he closes, and his "Good-night," though spoken in a voice that is gruff and broken with exposure and age, has nothing of want or sadness in it. As he moves away down the street to his lonely bed in the barn, the evening shadows close around him, hiding his bent form from us, as must soon that deeper shadow from which he will never emerge.

The tavern being long ago dismantled, the store now alone offers itself, a tamer place of evening resort. A large portion of the male population of the village drift hitherward of an evening with a punctuality that I fear has not always its reward. A number have trading to do, to be sure; but many come only to hear and tell what may have transpired during the day. Others, younger men, come for the mere sake of finding "something going on," they are such eager, restless fellows. I wonder parents do not oftener see to what a dangerous pitch of activity they may train their boys. Contemptuous of books and study, that youthful energy, which is so praiseworthy about the farm or in the shop, is prone to conviviality and mischief in its leisure hours. What rare men education would have made of some of these we might name! In contrast with these are those placid



"OH DEAR! WHAT WAS IT?"

natures who sit all the evening long, merely to pass away the time, adding little to the talk or merriment that is evoked about the stove.

To-night the boys who were in the army are telling their experiences, and vying with each other in the extravagance of their stories. One relates that he lay with his regiment one dark night upon the battle-field, sleeping close to one he supposed a mess-mate. Trying to waken his fellow-sleeper, at the call in the gloom of the morning, he found he had been nestling all night against a headless foeman.

With more of animation than he has manifested all day long beside, the drummer-boy tells that his regiment passed one night in bare

barracks. It was bitter cold, and their baggage was way back in the mud. "I waked up shivering in the night—almost froze," says he. "I was sure I heard the drums beatin', and jumped up, fumbly for my own. Then I thought it didn't sound quite like drums. I could hear the fellers shudderin' all about me; and, Sir, that noise was the thumpin' of their heads upon the bare boards as they shivered in their sleep!"

One other now takes his turn with great earnestness. A member of his company was hastily buried one day, as an immediate move was expected. As often at such times, the grave was rather shallow. "We didn't leave that day," he goes on; "and next morning I heard some one whistling out there, as contented as could be. And I'm a sinner if it wasn't I—. He had poked his head up through, and was mad because I hadn't brought his breakfast. Being a new hand, he supposed this a part of the service, you see."

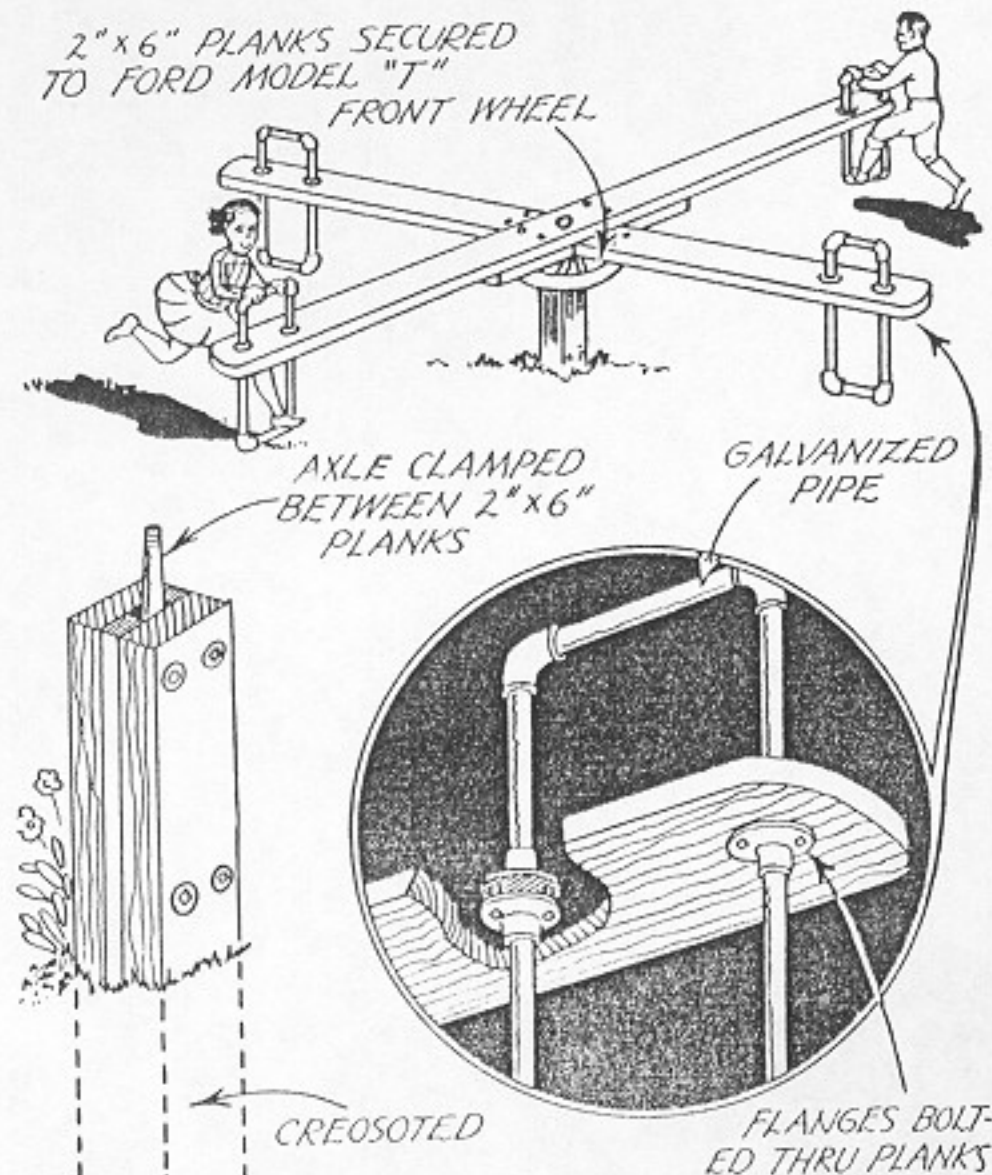
The best talkers do not generally stay long; it is the dull ones, those who do not know what else to do with themselves, who stay and bore each other beyond all reason. At last, all customers having gone, and the conversation lapsing into fearful inanities, we close the shutters as a hint, and our visitors button their coats about them and go away into the night—the stranded drummer last of all, and most reluctant to leave the stove. Ere the crunch of their footsteps has died away upon the quiet street we put out the lights and hasten to our own more secluded fire-side, glad that from here, at least, the world is shut out.

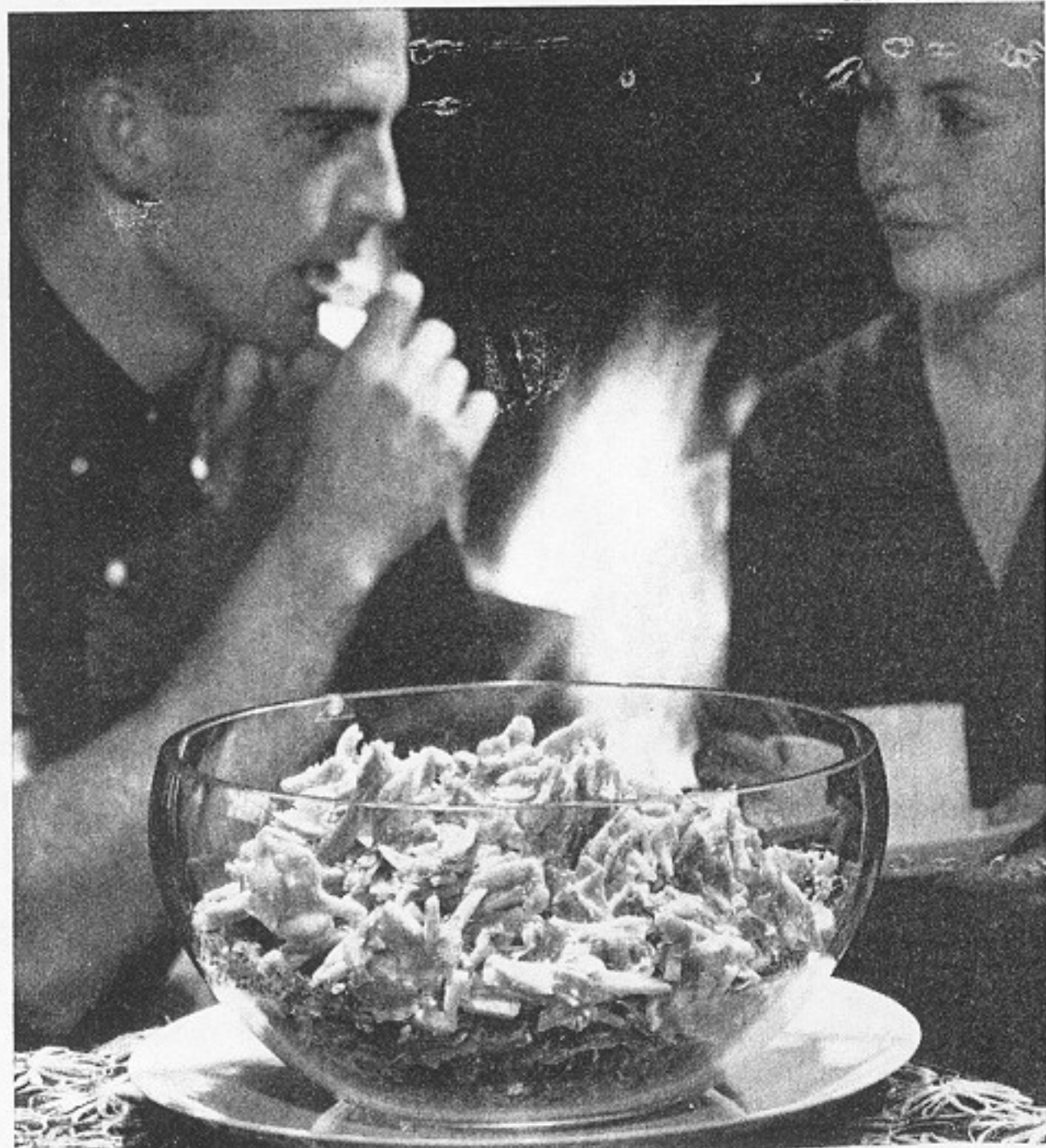
A Merry HOP-AROUND

POPULAR HOMECRAFT MAY-JUNE, 1939

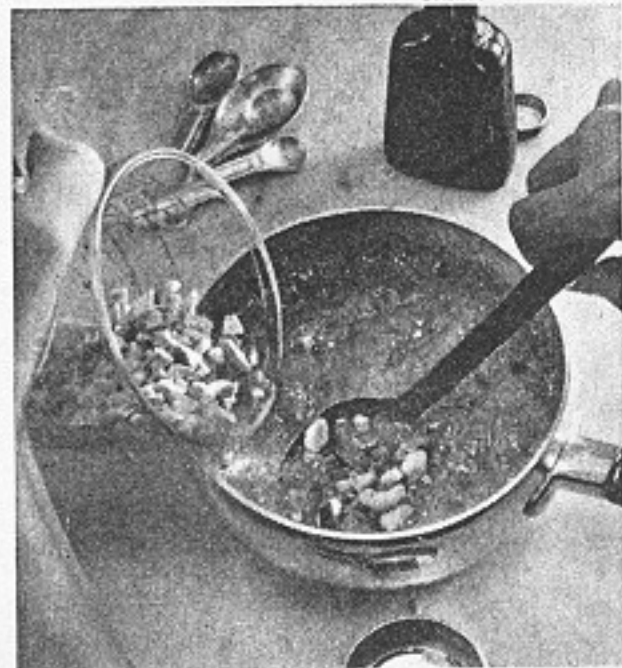
By HI SIBLEY

HERE is our old friend, the merry-go-round in a new form. The passengers propel as they ride, or one alone can push the other three around. Little effort is required because it is mounted on a roller bearing auto wheel picked up from a wrecking yard. As a front wheel is used, the spindle will need to be welded to a bar and mounted in the built-up post as shown. The planks are fastened to the wheel rim with U-bolts. Galvanized pipe and fittings assembled as shown in the circle serve as handle bar and foot rest. The supporting post should be creosoted below ground to forestall decay. The cost of this equipment is obviously very little compared to the fun the children will derive from it.





A big bowl of crisp, butter-smooth almond brittle makes a fine addition to a quiet evening spent by the fireside. This brittle is just one delicious variation of the basic recipe



Stir nuts into foaming candy mixture; pour immediately onto buttered marble or pan



Pull warm candy into ribbons, stretching as thinly as possible. Break into pieces

How to make nut brittle

SUNSET Jan. 1963

Making a batch of crunchy nut brittle is a pleasant evening's work for a family, or a good project for a group of older children after school—and it's work that provides its own reward. Keep this candy in mind, too, for holiday gift packages from your kitchen.

Peanut brittle, familiar to all, is but one of the many flavors possible; you may be surprised at the delicious variations you can get with almonds, macadamias, cashews, pistachios, Brazil nuts, and filberts. Roasted, unroasted, salted, and unsalted nuts are all suitable. We've noted the necessary adjustments in the basic recipe that follows.

You pull and stretch the butter brittle base to paper-thin wisps and ribbons while it's still warm (the thinner you pull it, the crisper the candy will be). You have to work quickly, so extra hands will be welcome.

candy towards the center). Store in an airtight container. Makes about $\frac{3}{4}$ pound. —E. R., Half Moon Bay, Calif.

VARIATIONS

Almond Brittle. Use almonds; flavor with $\frac{1}{2}$ teaspoon almond extract in addition to the vanilla.

Ginger Cashew Brittle. Use cashews; add $\frac{1}{4}$ cup finely minced candied ginger.

Exotic Pistachio Brittle. Use pistachios; add $\frac{1}{4}$ teaspoon ground coriander.

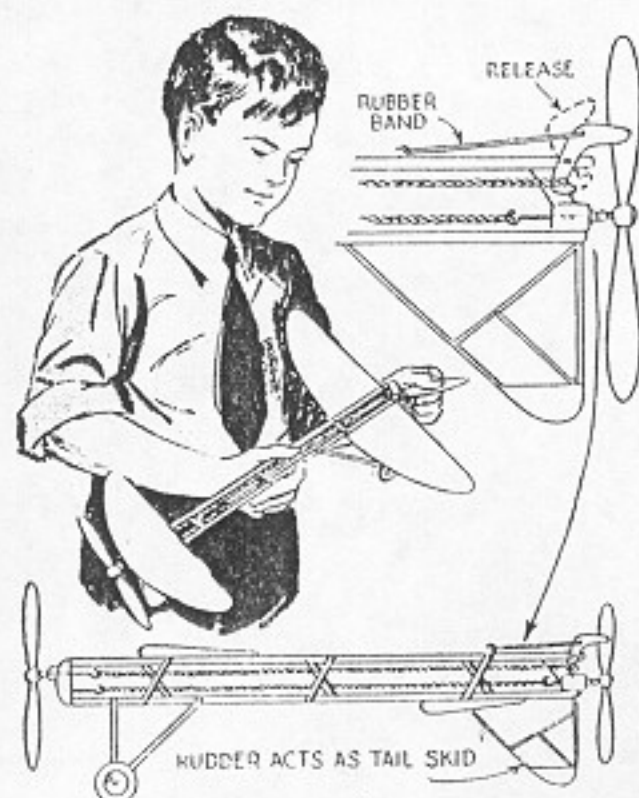
Brazil Rum Brittle. Use Brazil nuts; add $\frac{1}{2}$ teaspoon rum flavoring.

Burnt Sugar Brittle. Add untoasted chopped nuts to candy mixture when it reaches 290° (soft crack stage). Stirring constantly, continue cooking until candy reaches 310° . Remove from heat; add soda mixed with salt, then vanilla, and proceed as above.

WESTERN NUT BRITTLE

- $1\frac{1}{2}$ cups sugar
- $\frac{1}{4}$ cup each water and butter
- $\frac{1}{2}$ teaspoon soda
- $\frac{1}{2}$ teaspoon salt (if nuts are unsalted, use $\frac{3}{4}$ teaspoon)
- 1 cup chopped nuts
- 1 teaspoon vanilla

In a saucepan stir together sugar and water; add butter. Bring to a boil and cook rapidly, stirring occasionally until mixture begins to turn golden, then stirring frequently to prevent burning. When temperature reaches 310° (hard crack stage), remove candy from heat and blend in soda mixed with salt. Stir into foaming mixture nuts and vanilla; pour immediately onto a buttered marble slab or a large, rimmed, buttered baking sheet. Let cool just until you can touch it. With buttered hands, pull candy as thin as possible, letting ribbons form, and break into pieces (work from edge of

Twin Propellers Double Flight
Time of This Model Plane

Here is something new in model airplanes; twin propellers arranged in tandem so that one runs and then the other, almost doubling the time that the plane will stay in the air. The plane is made in the regular way except that the rudder is on the underside so that it serves as a tailskid. The rubber band operating the front propeller is fastened to a pivoted L-shaped arm, which engages the rear propeller and prevents it from turning until the arm is pulled back. As the band untwists in driving the front propeller, the pull on the arm is gradually reduced and a short rubber band fastened to the upper end of the arm pulls the arm back, allowing the rear propeller to rotate.

—Kenneth Howard, French Lick, Ind.

POPULAR MECHANICS

September, 1928

WATER HYACINTHS ARE TURNED
INTO CHEMICALS

Long considered a pest in southern rivers, the water hyacinth has commercial possibilities as a producer of chemicals and alcohol, a Calcutta scientist has discovered. From it, he has obtained pure potassium chloride and power alcohol, he reports, and the pulp that remains after the dried plant has been treated, is suitable for making strawboard.

HOW TO MAKE HARDTACK

Hardtack goes back to the American Civil War and probably long before. It was simply white flour mixed with a minimum of water, rolled out to the desired thickness, cut into squares and then baked. The dough was unsalted as salt attracts moisture. If hardtack has no other recommendation, at least it keeps.

Hardtack was a field substitute for bread. It was compact and relatively light. Even the best was barely edible and had to be broken up for soup or dunked in coffee as it was too hard to chew. It had little nutritive value but it was filling.

I've devised a hardtack which is easy to make, cheap and highly nutritious. It has a bland taste but is not at all bad when spread with margarine and salted. It is indeed compact and will keep well into the 23rd century if stored in plastic.

Mine is a mixture of one-third corn, one-third rye and one-third wholewheat flours. The flours can be bought at any natural food store but you should buy whole grains at the same store. With a hand grinder, also sold there, you can grind your own at about 20 cents a pound.

No bread product is simpler to make. Just weigh out a half pound of each flour and mix well in a fairly large bowl. Next add one and three quarters cups of water. Pour the first cup and fold the dry flour into the water until it is absorbed. Then continue to mix with the hands, pouring a quarter of a cup and kneading until the flour is in a ball and there is no more loose flour. This takes about five minutes.

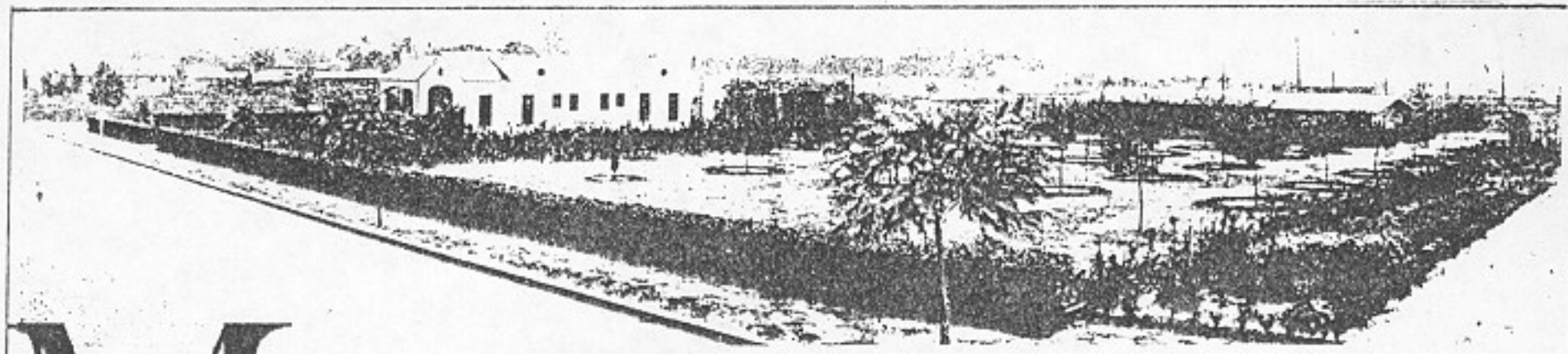
Then pound it down with your fists and finally roll it out with a rolling pin until it is about a quarter of an inch or less. As dry as it now is, it won't stick much and a long knife blade can loosen it from the counter.

Next take a butter knife and cut the dough into squares about the size of soda crackers. Put the squares into regular 10 by 15 inch, ungreased baking pans. The batch should fill two pans.

Set your oven to 425 degrees and preheat for about ten minutes, or when you begin preparing the dough. Now put the pans in the oven and bake for twenty minutes. Then just turn off the oven and let the hardtack alone until the oven cools. The first twenty minutes will cook the hardtack and the time of the oven's cooling will dry it. At first, the hardtack is somewhat chewy. But by the next day it will have set to a completely dry consistency. If you weigh it now, it should weigh one and a half pounds, having gotten rid of all the water.

These are excellent for travel as you can munch them along and have no need for other food for days. They are also good for snacks and can also be considered a good barter item.

If you have a dog, they make the best nibbles. Our dogs love them and if you've priced the commercial dog nibbles you'll see the savings.



Nine years ago Frank Fasano bought this two-acre farm at Chula Vista, Calif., for \$2,000. Today it pays an income of \$2,000 a year with every foot under intensive cultivation. Recently he refused a \$15,000 offer for it.

Midget Farmers

Beat Hard Times

Six Thousand Men and Women in California Make Yards Pay for Their Homes While Holding Other Jobs
POPULAR SCIENCE Sept. 1931

By H. H. DUNN

NINE years ago, Frank Fasano and his wife paid \$200, their combined savings, on a purchase price of \$2,000 for two acres of land in Chula Vista, Calif. Frank had a job in town that paid \$35 a week. For six months, the Fasanos used some of this pay check to prepare their land.

Since that time, this land has paid the annual instalments on the purchase price,

the interest on deferred payments, built a five-room, modern house, and converted every foot of the two acres to production. The pay check has gone for living expenses, an automobile, entertainment, and other costs of living.

The Fasanos have refused \$15,000 for their place, which pays them \$2,000 a year.

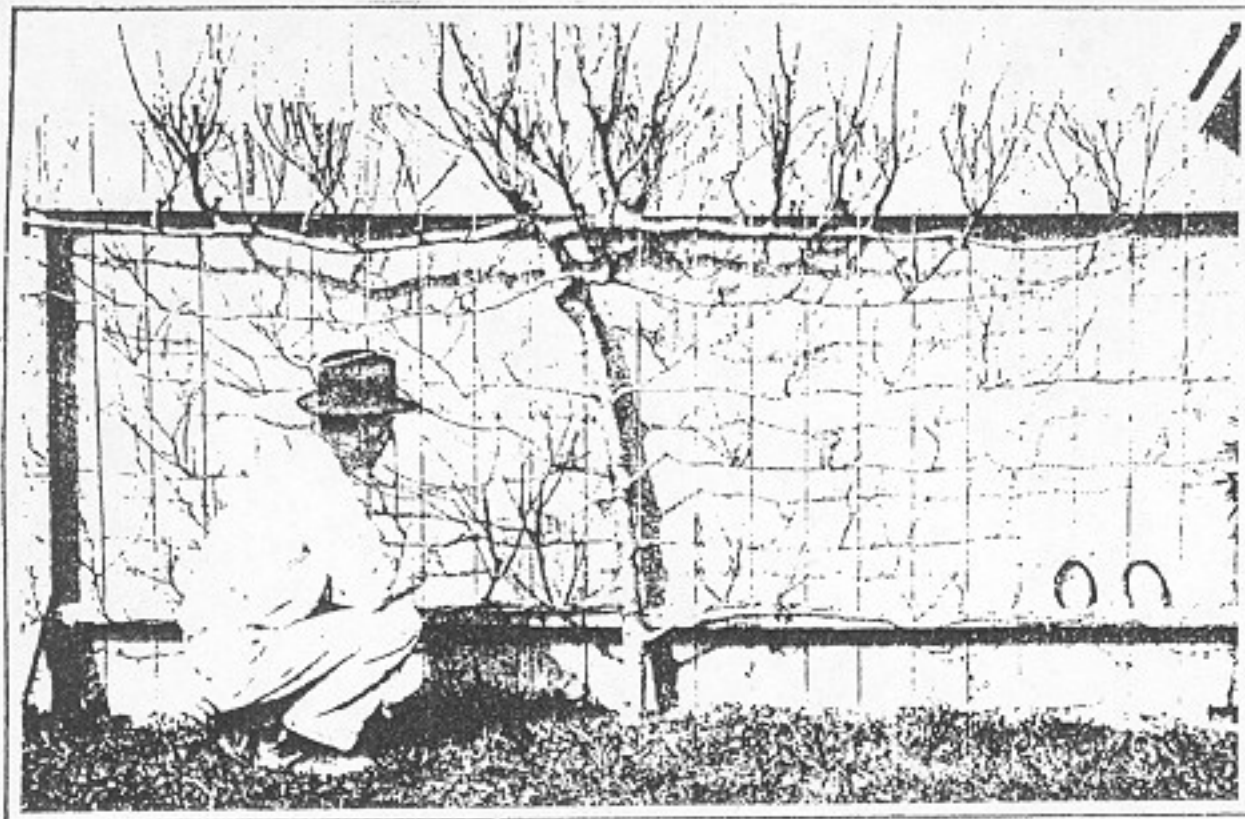
Mrs. Pearl Evans, left a widow with two small sons, bought two acres of bare land, at the village of Muscovy, Calif., a little more than a year ago. She works six hours a day, six days a week, on the midget farm, while the boys average three hours a day each. The place produces all the chickens, eggs, vegetables, and small fruits the family of three can eat, and has paid the monthly instalments and interest on the purchase price. In addition, the two acres provide room and food for 600 laying hens and nearly 1,000 half-grown chickens.

THESE are two examples from more than 6,000 families in southern California who have learned how to make the yard pay for the home. They are all in towns or cities or in the suburbs, for the great majority of them must be within easy reach of transportation to and from their jobs. Some of them who have been at this new business of making a home pay for itself for ten years, now own their homes, and the yield from the midget farm is net profit, less taxes and upkeep.

Many of them, like the Fasanos, have brought their midget farms to such condition that they are in a position to retire from their daily employment and live, with an average of sixty to eighty



On the tiny ranch everybody works, including father, and that is the real secret of its surprising success. Upper left, dry-land geese that require no swimming pond are raised on the midget farms.



Room is precious on the tiny farms, and as a result fruit trees, like the peach tree shown here, are trained flat against a wall. In this form more sunlight reaches them, increasing the yield.

hours' work a week, on their own ranches. Most of the 6,000 have been following the plan for only a short time, and still more are trying it every year. Bankers estimate that the failures have averaged less than six to the thousand, or about one to every 165 families.

There is no colonization project, no employers' aid, and no small-farm-tract scheme in this widespread economic success. The 6,000-odd midget-farmers are scattered through more than fifty cities and towns, each on land of his or her own purchased independently, and developed along nearly a score of different plans of production to meet the costs of the farm.

SOME of them have been able to make successes on one large city lot, but the great majority buy from one half acre to two acres, the average being one "commercial acre"—that is, a standard acre less allotments for sidewalks, curbs, and alleys.

Probably ninety-five percent of these working farmers have had no previous experience as agriculturists, horticulturists, or poultry raisers. In the selection of soil and location, and in the choice of crops for each farm, they have the technical assistance of the agricultural department of the chamber of commerce at Los Angeles, a bureau organized for this purpose when the commercial organization saw the extent to which this movement was developing.

On application by the prospective purchaser, this department sends soil experts and appraisers to the land. The expert makes a full report as to character of soil, what it will produce, crops best adapted to it, irrigation and drainage conditions, and the kind of fertilizers to be used. Then the appraisers tell the would-

be buyer just what the land is worth and what he should pay for it.

No real estate dealer has any connection with this department or influence with it, a fact that has had a great deal to do with the success of the midget-farmers. In addition, the state department of agriculture gives the home owners free information as to soils, crops, and methods of cultivation and planting.

The Los Angeles County Regional Planning Commission made a study of more than a dozen districts in Los Angeles and Orange Counties, to find and map those areas in towns and in cities or their suburbs best adapted to the individual development of self-sustaining homes.

In Los Angeles County, there are thirty-five towns of 10,000 or more inhabitants. At present 4,850 heads of families are living on miniature farms, virtually all of them being employed in these towns. Approximately 1,200 more such families have similar pay-their-own-way homes in about fifteen other cities and towns of 10,000 or more in the remainder of southern California.

ON ONE acre, at Van Nuys, Los Angeles County, Mr. and Mrs. Sam G. Price have twenty-one bearing walnut trees, six years old. These trees produce between 300 and 400 pounds of nuts a year, selling for \$65 to \$75. They have 150 laying hens, kept in a twenty-by-sixty-foot space, covered by an open-front, university-type chicken house. The first year, these hens paid for their original cost of \$1 each, which was at least twenty-five percent too high, and for their feed.

They have since paid for their feed, supplied all the eggs and chickens eaten in the home, and have paid in cash a little better than \$150 a year into the family pocket-book. In addition, every year has seen the Prices selling a minimum of \$100 worth of "broilers." From six hen turkeys, a minimum of fifty birds are sold each year. These bring better than \$100 more than the cost of their feed.

Averaging the walnuts at \$70, this is a cash income every year of \$420, or seven percent interest on \$6,000. Price's place cost about \$4,000. In addition, this family charges off \$200 for the chickens, turkeys, and eggs consumed by themselves. Beyond this, they raise all the green food, and some of the dry, that the poultry consumes, and all the fresh and canned vegetables, small fruits, and nuts that the family uses during the year.

Price, who works every day in Van Nuys, has kept an accurate record of the development and costs of this midget farm, and finds that he averages three hours a day, six days a week, in making his yard pay for his home. The \$35 a month income from the place, with \$10 a month added, covers payments on principal and the interest on the mortgage.

THESE midget farms are not gold mines; there is seldom such a thing as making them pay an income equal to that which the salaried worker receives, but thousands of city-employed are working out a new kind of "one-acre-and-liberty" life, on land that costs less than the equivalent of a city lot and house, which must be paid for out of the salary check, and whose yard can contribute little toward paying for itself.

The survey above mentioned shows that the average family in this group of midget-farmers is between four and five, though some range as high as nine, and others as low as two. As has been said, average size is one "commercial acre." The average cost



Women as well as men can work these one-acre ranches, and here one is pruning the blackberry vines that pay interest on the mortgage. Below, terracing on a small farm to raise avocados and tangerines.

is \$1,500 per acre, dropping to \$800 in smaller towns, and rising to \$2,000 in close-in sections of larger cities.

Homes on these farms cost from \$500 to \$600 a room, with the average nearer the former figure than the latter. A total investment of \$4,000

will provide the worker with a one-acre farm and a five-room house. His original payment, in the great majority of instances, if he has a steady job, will be ten percent of the total, or \$400. The remainder can be paid off, including interest on the deferred payments, at \$40 a month. There are few, even among the half-acre homes, that do not pay this much or more a year, with an average of twenty to twenty-five hours work a week.

OWNERS of these midget farms range from college and high school professors and instructors to day laborers. Salaries range from \$25 to \$100 a week, with an average of between \$35 and \$40, or, say, \$2,000 a year. On an investment equivalent to, or somewhat less than, that for a city lot and house, the midget-farmer adds \$400 to \$600 a year to his income from the produc-

tion of his land, and still is within transportation range of his job.

If he is an office worker, he gets the benefit of two or three or four hours' work in the open air every day, and he does not need, after the first six months or year, to draw from the pay check to buy himself a home. He pays himself his own rent in the form of savings for the future, while he still can continue his savings from his salary.

Crops produced by the midget-farmers range through everything grown on the largest farm in the country. One man, his wife, and three children earn an average of \$950 a year on a half-acre by raising guinea pigs and goldfish, the former for medical research laboratories and hospitals, and the latter for pets and for stocking lakes in parks and on large estates. The goldfish pool also produces thousands of water lilies in season, as well as great sheaves of lotus blossoms, commanding as high as twenty-five to thirty cents a flower from florists.

This midget farm produces all the food of the guinea pigs and a large part of that of the fish, while the family raises all its own fruit and vegetables and keeps a small flock of chickens that supply all the poultry and eggs eaten by the family. The owner is a

bookkeeper, and he has kept accurate labor and cost figures. These show that he has spent an average of two and one half hours a day, with six hours on Saturday and one hour (feeding time) on Sunday. Two of the children have averaged an hour a day, each, except Sunday.

THE wife does none of the farm work, and has a woman in to help her at least one day a week and often two. This man, A. C. Perkins, had saved \$575 when he bought this half-acre for \$950, rather more than the average price. With the exception of the first two months of his occupancy, while his five-room house was being built, he has paid nothing out of his salary of \$50 a week toward the cost or upkeep of the property, and he has house and land more than half paid for! When he started, he had had no experience with guinea pigs, goldfish, water lilies, chickens, or any kind of farming.

Hundreds of similar successful cases are on record in the files of the Regional Planning Commission. These show that "specialized farming" of the midget farms pays best,

just as it does with larger farms, and they are most successful who are most regular in their hours of work, and who devote as much study to their farms as they do to their jobs in the city. Chickens, turkeys, ducks, geese, and occasional flocks of guinea fowl seem to be the backbone of the food crops, furnishing also the quickest cash return. Small fruits and vegetables come second, with rabbits, for food and fur, next, while there are more than one hundred small farms devoted to unusual production, such as the guinea pigs and goldfish, white rats (for laboratories), bullfrogs, bantam chickens, and pigeons.

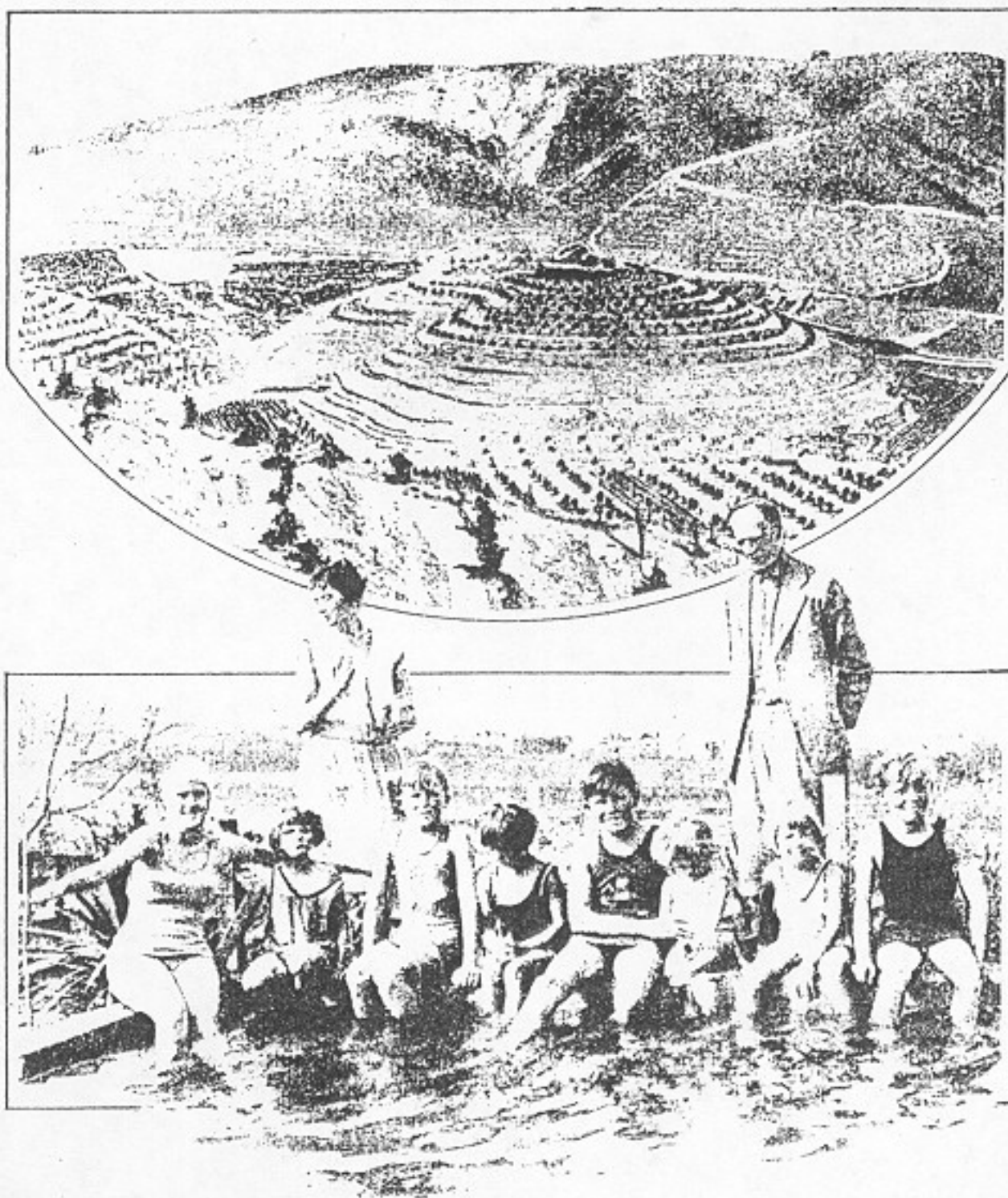
The fruit and vegetable growers have developed two new and interesting features in horticulture. The first is the making of two or three trees, berry bushes, or vines grow in the space formerly given to one. The second is the terracing of foot-hill land, which can be bought at comparatively low prices, for the production of avocados, tangerines, table grapes, and grapefruit.

BY PRUNING peach, pear, apricot, and other deciduous fruit trees flat against fences and trellises, two to three adult trees can be grown in the space ordinarily given to one. Production of fruit is increased from twenty-five to thirty percent by this method, due to increased penetration of sunlight.

Rotation of crops, of course, has been reduced to a fine art by these midget-farmers. Four years ago, Professor C. A. Stebbins, with his wife and seven children, bought an acre of bare land near San Fernando, Los Angeles County. Stebbins is a member of a high school faculty. On their one acre, with the work accurately divided among all nine members of the family, they produce all the small fruits and vegetables they eat, and about seventy-five percent of the meats, with all the eggs.

The reservoir for irrigation of this midget farm is also a swimming pool for the family, and was built, along with the poultry houses, rabbit hutches, and lath-house, by the father and two older sons. In fact, everything but the house was constructed by these three, while all their trees, berry bushes, and ornamental shrubs were grown in the lath-house by themselves. Professor Stebbins expressed still another view of the midget farm when he said to the writer:

"Our one-acre farm is strictly a business



Primarily this is not a swimming pool, though it obviously is going to be used for that purpose by the children of the family. Really it is the irrigation reservoir that waters this midget farm.

proposition, and our business in life, as we see it, is giving our large family of boys and girls an environment in which they may have room to expand physically, mentally, and spiritually. We believe that this objective is possible of real achievement only in country living.

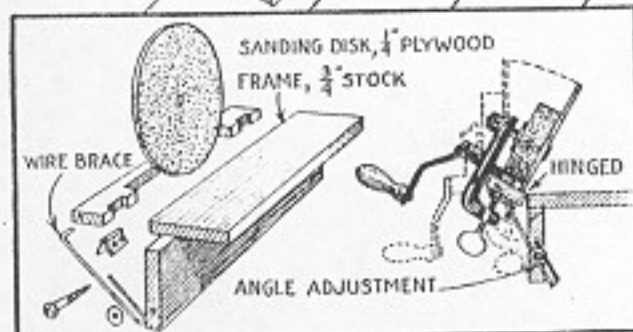
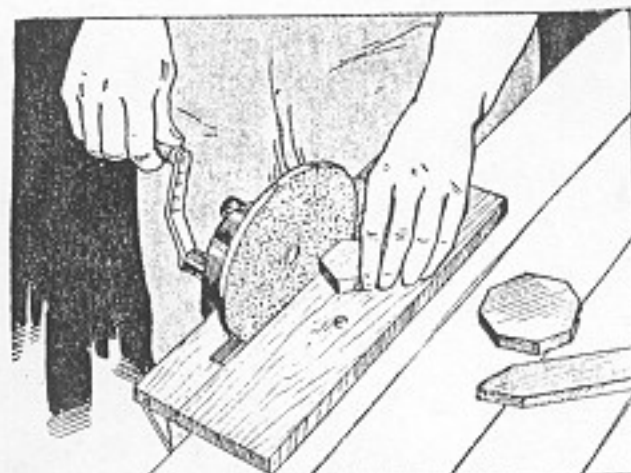
"We have found, however, that the midget farm gives space to body and mind in which the child may work or play and develop along free and natural lines. It offers contact with plants and animals that draws out the desirable characteristics of reliability, accuracy, punctuality, patience, and love. Our children have become rural-minded and the excitement of the city has little or no appeal to them. And they are healthy. We have no family doctor, and since we came here, we have paid no doctor's bills."

CIVIC societies hold that the greatest factor in the complete absence of tenement districts and slums in the cities and towns of southern California is this individual and independent movement to the midget farm. Recently, a contest on plans and methods of operation, payment for, and maintenance of, these miniature ranches was held in Los Angeles. In this, Professor Stebbins won first prize, and out of the hundreds of plans and systems submitted, all of them successful, the fact developed that only a few had used horses or mules, plows or harrows, in the preparation and cultivation of their farms.

Average production of these 6,000 small farms in southern California is placed at a minimum of \$400 a year, including sales and value of food consumed in the home.

Hand-Operated Bench Grinder Converted to Disk Sander

Popular Mechanics
February, 1937



Light materials such as trimmings and model work are readily handled by this simple sander

Popular Mechanics March, 1937

Tears in Cushions Sewed so That Threads Won't Pull Out

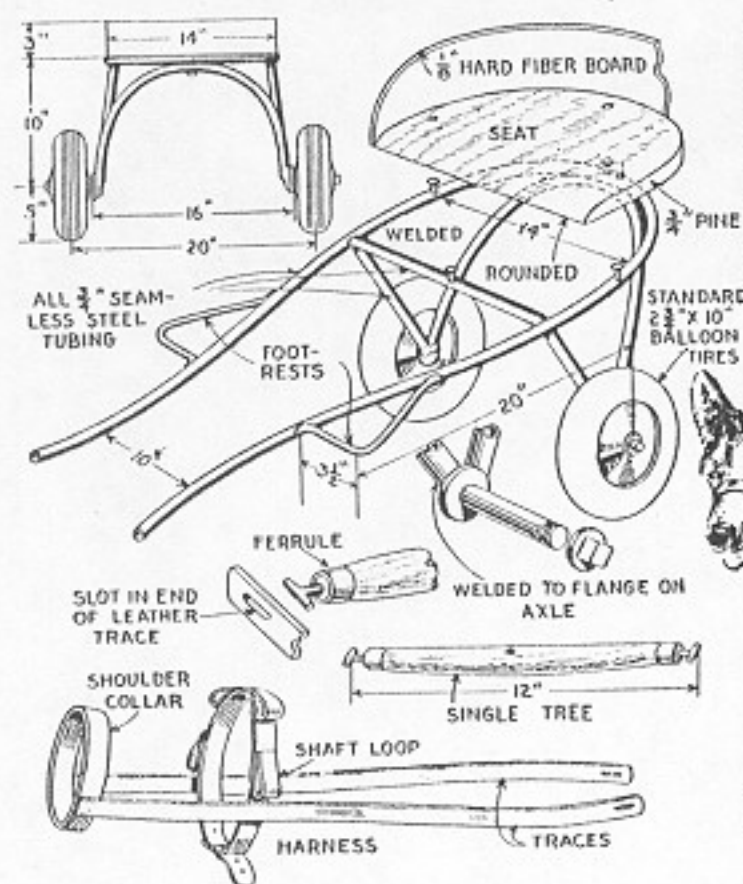
When an upholstered spring cushion has a tear and the fabric is pulled apart by the under-padding so that it is difficult to close neatly, try the following method of repairing it: First make long stitches across the opening. Then pull them up, gradually drawing the torn edges of the cloth together. When the edges overlap slightly, sew them together with thread that matches the cloth, taking neat, small stitches, close together, as in the lower detail, after which the long stitches are removed.—G. E. Hendrickson, Argyle, Wis.

Water stains on glass pitchers, vases and aquariums usually can be removed by rubbing them vigorously with a piece of freshly cut potato or a cloth which has been moistened with potato juice.



Popular Mechanics March, 1937

Dog Racing Sulky Fitted with Balloon Tires



Light and strong, this sulky is easy to make from seamless steel tubing, which is heated with a blowtorch and bent in a vise. Any garage having welding equipment will do the job of joining the parts at a nominal charge. Although the dimensions given were suitable for a police dog, the shafts and harness should be adapted to the size of the dog. Balloon-tired wheels fitted with ball bearings give a smooth ride and, as the seat is placed a trifle behind the center of the wheels, the animal carries very little of the driver's weight. A singletree is important as it allows the tugs to move back and forth as the dog runs without chafing his chest.

A disk sander for small jobs is easily improvised from a bench grinder. It has been found especially suitable for sanding all kinds of trimmings and for model work. No alteration of the grinder is necessary as a plywood sanding disk is merely substituted for the grinding wheel. A right-angle frame is made up as indicated and

a recessed strip, to which the grinder is clamped, is hinged to it. The hinged strip is adjustable by means of a heavy wire or rod brace to set the sander at various angles. The assembly is attached to the edge of the workbench with a heavy screw.

SUNSET MAY 1966

These individuals are rock dolls

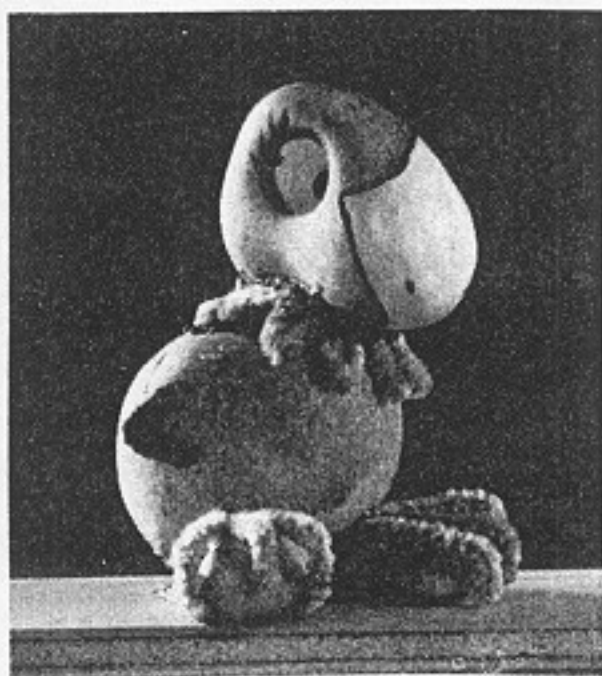
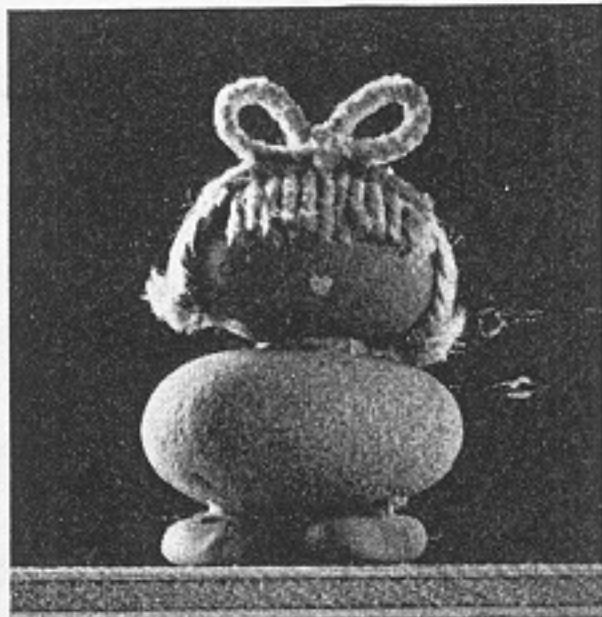
On a visit to the desert or the beach, families can collect all the raw material they need for the project of making "rock dolls."

It can be a challenge to the imaginations for any age group. Let the varying shapes of the rocks, in combination, suggest the people and animals that your dolls will represent.

After you glue a rock head, hands, and feet to a stone body and then decorate it, you may see a use for it as gift, ornament, or toy.

Wash the rocks (they dry rapidly) and spread them before you on newspapers, stacking and combining them experimentally. (Don't combine rocks in precarious balance, or you'll put too much strain on the glue.)

DARROW M. WATT



Using the proper glue for this project is important. You'll want something quite thick, so you can use your fingers or a toothpick to build up a little platform or collar of glue. Then, in its collar, one rock will sit securely on another in spite of irregularities in the shapes of both rocks. You also need a good strong glue so that the rocks will not break apart. The epoxies are best for strength, and a number of them are thickened in various ways. There is also an epoxy putty that works well. If you have difficulty finding these at the hardware store, try a marine supplier.

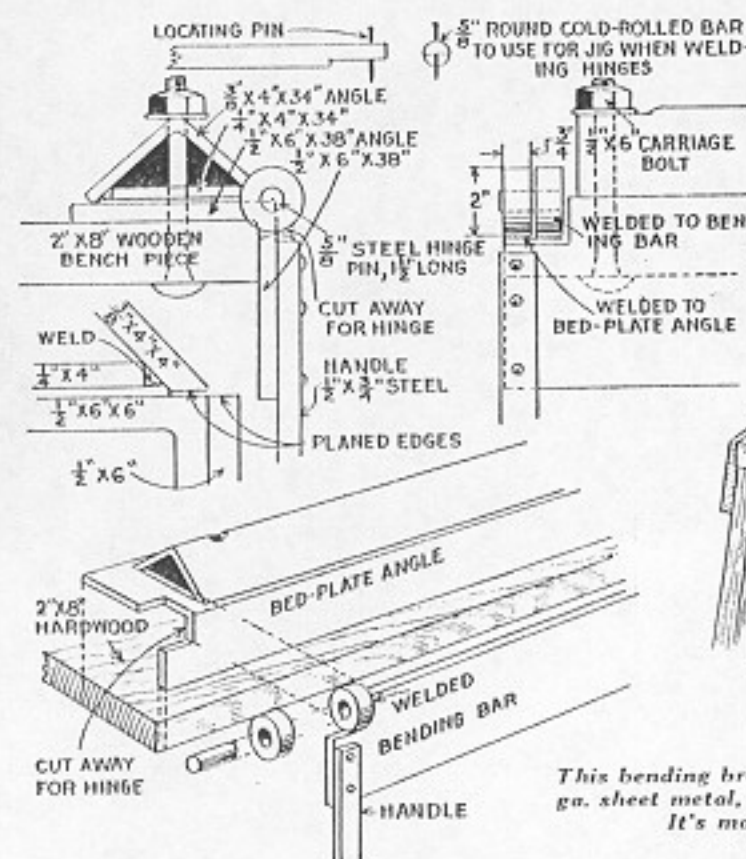
Decorate the dolls with wigs, faces, and props. Use white glue to attach colored pipe cleaners and construction paper. In general, though, it's best to go light on decoration and let the figure take its character from the peculiarities of the rocks themselves.



Rock dolls are fun to make: girl with twine hair, parrot with pipe-cleaner feet and ruff, gentleman with newspaper

POPULAR MECHANICS March, 1937

Handy Bending Brake for Use in Small Shops



This bending brake will make clean, sharp bends in No. 16-ga. sheet metal, and will take a sheet up to 30 in. in width. It's made from steel bar and angle stock

Built of steel angle and bar stock, this bending brake will handle No. 16-ga. iron up to 30 in. wide. Some machine work and welding are necessary. First, a stiffening bar is welded inside the angle hold-down as indicated in the end views. The second job consists of welding the two parts of the hinge in place, one to the bending bar, the other to the notched end

of the bed-plate angle. Then the forward edge of the hold-down is planed true and one face and edge of the bending bar are milled flat. The hinge consists of two disks cut from cold-rolled shafting, each center-drilled for a 1/8-in. hinge pin. These are held in place for welding by means of a jig as in the top detail.

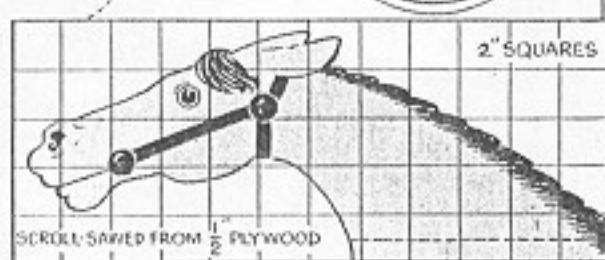
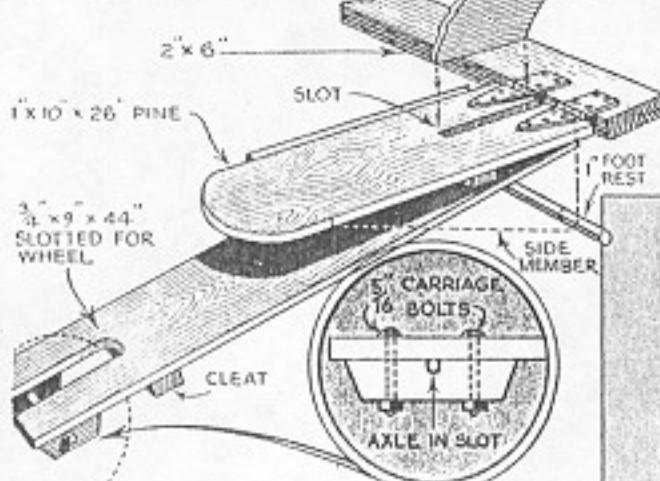
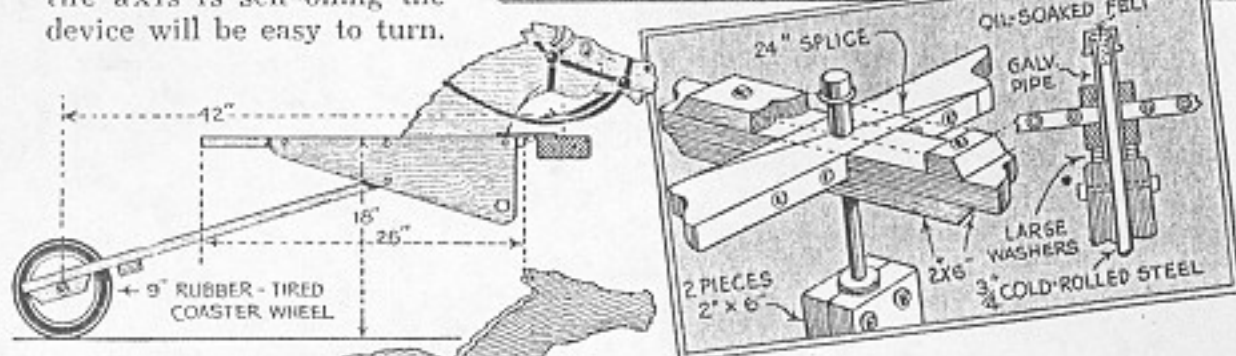
—G. F. Lampkin, Bradenton, Fla.

December, 1933

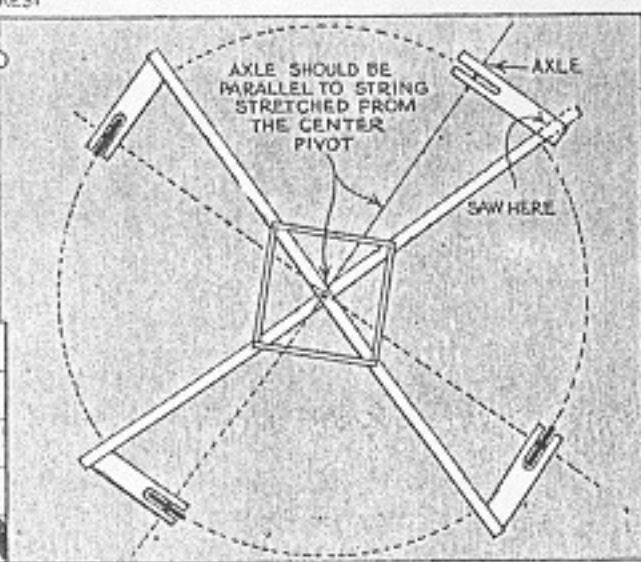
August, 1939

"Steeplechase" MERRY-GO-ROUND in the garden playground

YOUNG jockeys will get plenty of action on this merry-go-round as their steeds take the hurdles. A mere path of hard-packed soil with a little hummock or two forms the circular race track. The hummocks should be on opposite sides so that the effort of pushing one horse up the incline is counterbalanced by its mate coming down the opposite one. The center post is creosoted thoroughly and is set deeply in the ground. As the axis is self-oiling the device will be easy to turn.



To prevent side drag of the wheels under the horses, the latter should be attached to the cross members at an angle, which is found by stretching a string tautly across the center pivot as shown below



Paper Scraps Keep Chickens From Eating Eggs

One man found that if small scraps of paper are sprinkled in front of the nest, chickens will be discouraged from eating eggs. The paper should be approximately the color of an egg so the chicken will think it is eating eggshell. After this, the chicken is no longer interested in eggs.



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This Man Bought a Microscope, Set It Up on a Street Corner and Employs It to Earn a Living

MICROSCOPE AND WATER DROP AID MAN TO MAKE LIVING

One man has solved the unemployment problem as it affected him, with nothing more than a drop of water and an inexpensive microscope. He purchased the instrument, obtained a few slides showing life in a drop of water and other simple things which can be viewed through a microscope, and set up a sign inviting the public to look through the lens. He makes a small charge for this, and takes in fifteen dollars a week or more.

Neat Display Trays in Fruit Store Quickly Cut from Cartons



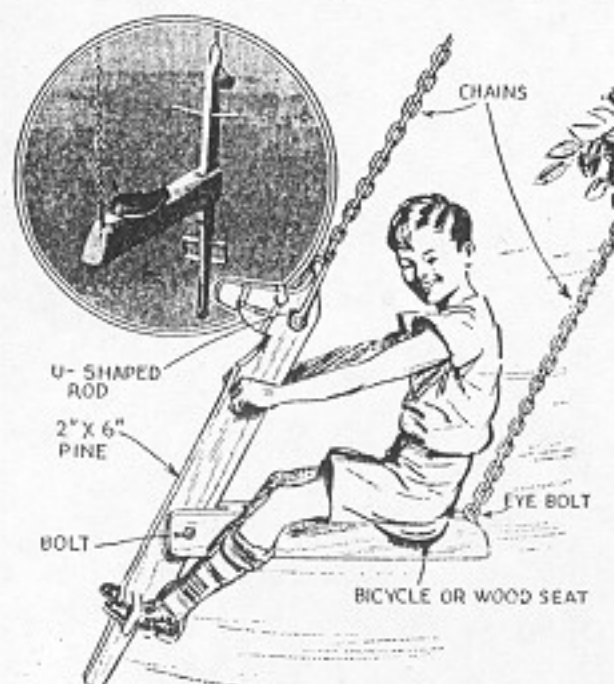
These simple but neat trays to display fruit and vegetables will help to increase sales. With a ruler and sharp knife, cut up some empty cartons, as shown in the detail. Each tray consists of two parts, both of which are corners cut from the box. A coat of furniture lacquer or automobile enamel improves the appearance considerably and gives your store an exclusive atmosphere at a slight cost.

POPULAR MECHANICS

May, 1939

Playground Pony Swing Is Pumped by Hands and Feet

Children get plenty of excitement and healthy exercise from this novel swing, which is shaped like a horse and pumped with the hands and feet. The body, about 40 in. long, is a 4 by 6-in. timber with the edges rounded to suit. The seat is set far enough back to give leg room for the child.



The upright has metal hand holds and looped stirrups, and is pivoted to the body with a $\frac{1}{2}$ by 5-in. carriage bolt. For added wear, this bolt should turn in bushings made of pipe. Either rope or chain can be used to suspend the swing as indicated. The horse shown in the photo was hung from 30-ft. lengths of chain, which gave a tremendous sweep.

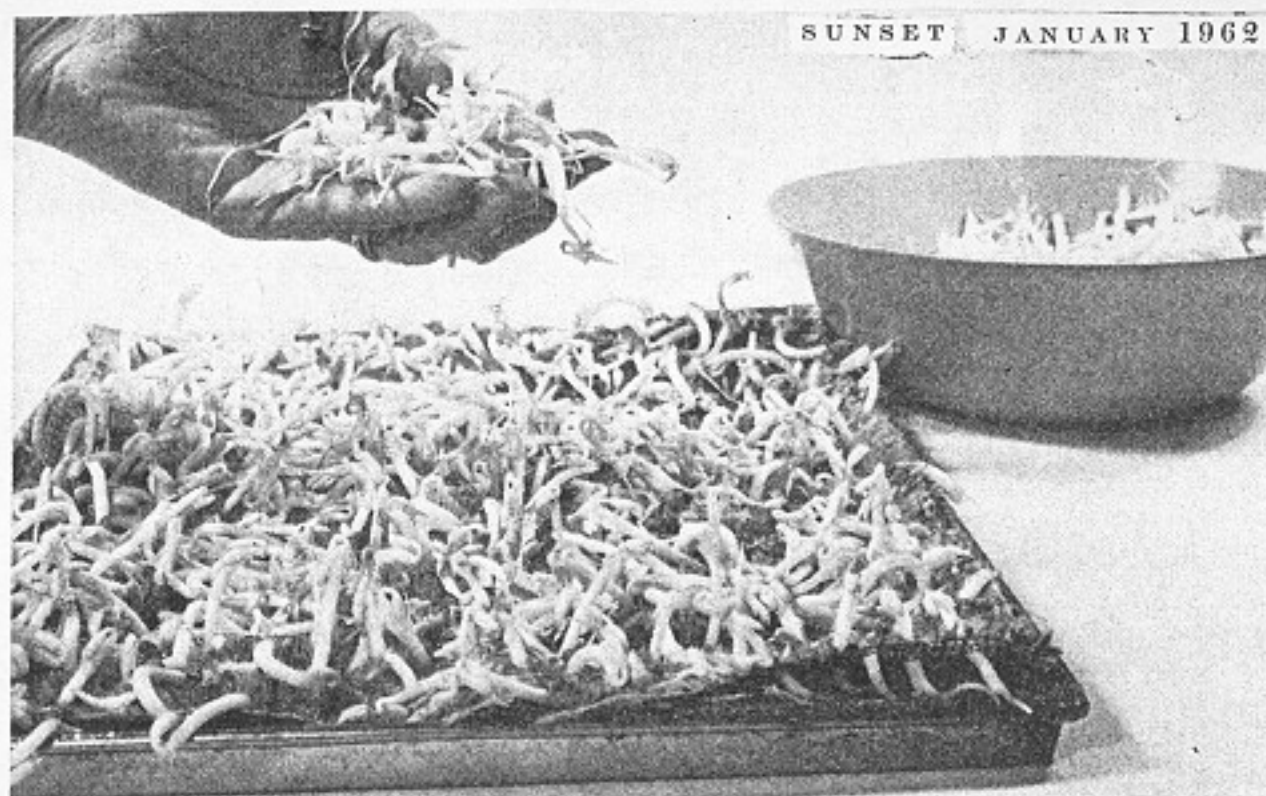
—Dale R. Van Horn, Lincoln, Nebr.

Popular Mechanics
August, 1931

TEARS POISON TO GERMS

Tears have a very practical purpose. An English biologist has discovered that tear fluid, even greatly diluted, is an exceedingly powerful destroyer of bacteria.

The bacteria poison in tears is so strong that a solution of 40,000 parts of water to one of the fluid fully retains its germicidal property. Presence of this powerful antiseptic in the tear ducts undoubtedly protects the eye from many germ-carried ills.



Bean sprout harvest comes in five to seven days. An 8-inch pan will produce enough sprouts for four people. Beans' outer green husks wash off when held under faucet.

(Mung beans are sold cheaply Chinese bean sprouts . . . by all health food stores)

Grow them right in the kitchen

Here's a trick we learned from a Chinese cook and had confirmed by a professional grower: Bean sprouts, a major ingredient in Oriental cooking, can be grown in a kitchen cabinet or basement.

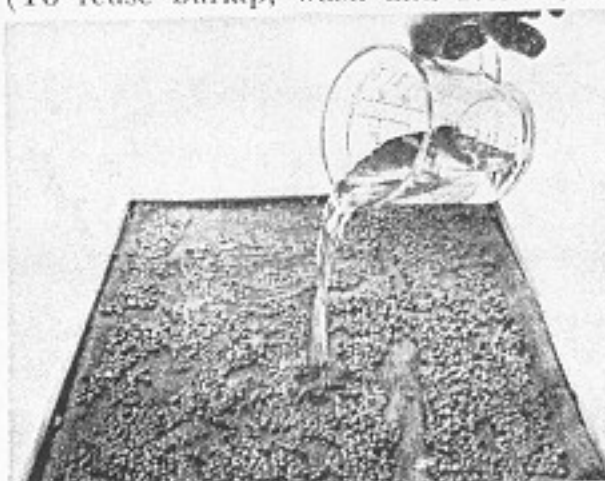
You can buy 1-pound packages of the necessary soybeans in most Chinese stores. (One pound of beans produces 6 to 8 pounds of sprouts.) Ask for mumble beans, sprouting beans, or Ming beans. Actually they're Mamloxi soybeans, a smaller sized variety of the soybean used in cooking.

Using a cake or baking pan with $1\frac{1}{2}$ to 2-inch sides, cover the bottom with four smooth layers of clean burlap cut to size. Sprinkle about a half cup of beans over the sacking; saturate the whole thing with water and pour off any excess. Water daily or when the top layer of burlap dries out. (To reuse burlap, wash and sterilize in

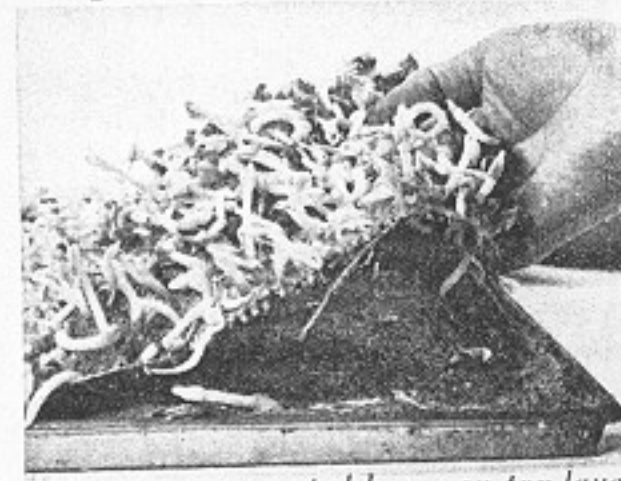
boiling water.) One of the determining factors in raising sprouts successfully is keeping them at a relatively constant temperature—68° to 70°—in a dark place where they won't be subject to grease or oily deposits that may be in the air from cooking.

The beans sprout within two or three days and are ready for harvest in five to seven days. After you pick and rinse them, they'll stay fresh and crisp two days in a plastic bag in the refrigerator. If you find you have harvested more than your family can eat in a meal or two, you can freeze the remainder in meal-sized portions for later use.

Besides being an indispensable ingredient of many Chinese dishes, bean sprouts add crunch to green salads and dress up such vegetables as buttered carrots or string beans (stir in just before serving).



Pour or sprinkle enough water on beans to thoroughly saturate layers of burlap



Here you see sprouted beans on top layer of burlap; 3 more layers are fitted in pan

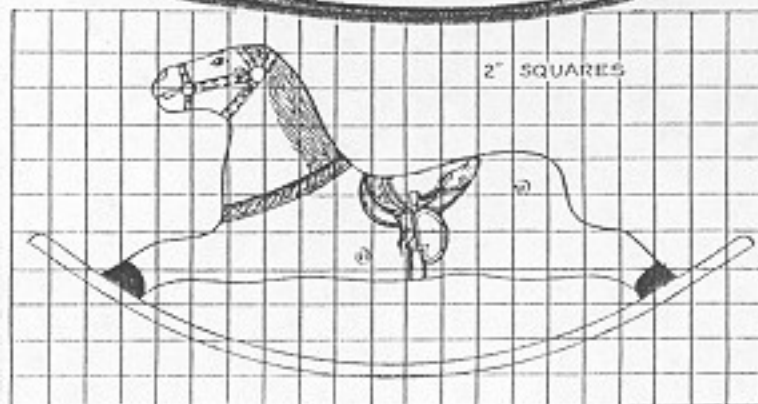
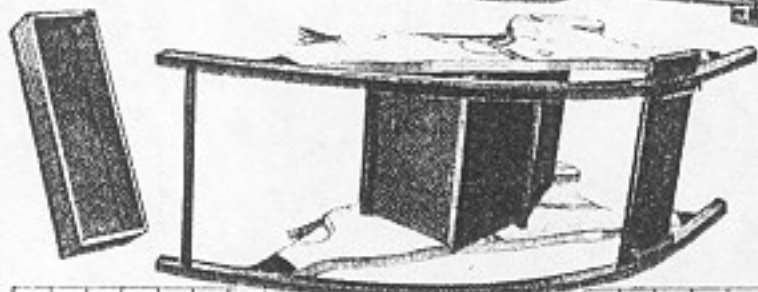
Popular Mechanics August, 1931

This GALLOPING TEAM KEEPS the BABY BUSY

by
H. W. Magee

ALTHOUGH not new, this galloping team is one of the best animal toys to keep your baby happy for many hours. Besides merely rocking, the child soon learns to travel all about the house, and if the ends of the rockers are covered with strips of rubber, no scratches or marks will be left on the woodwork.

Poplar is the best wood to use. The rockers should be bent to shape from suitable lengths of the same material, which is a comparatively easy matter when thoroughly soaked in boiling water. It is not advisable to cut the rockers as they are likely to



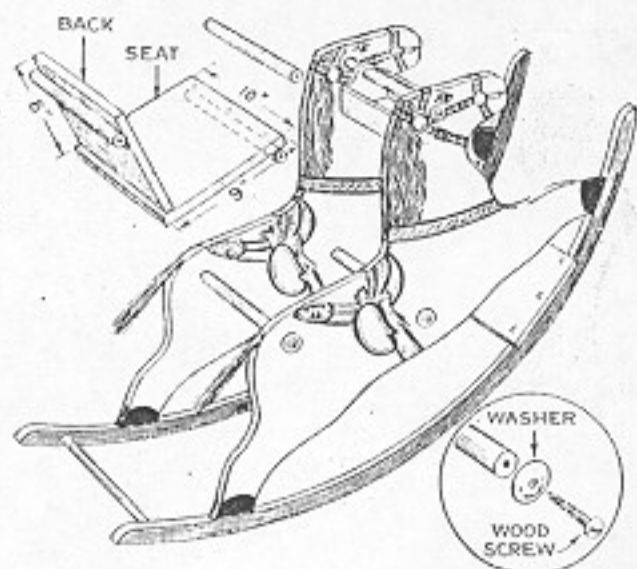
split where the grain crosses the stock at the ends. Get a large sheet of wrapping paper and rule it off in 2-in. squares; then draw the outline of the horse over these squares as closely as you can to the template given here. Variation from this design is likely to affect the balance. Stock of $\frac{3}{4}$ -in. thickness is used for the horses, while $\frac{1}{2}$ -in. material is satisfactory for the seat, tray and footrest. The grain of

rockers. As strong joints are necessary between the rockers and the horses' feet, 2-in. wood screws are used at these points. In bending the rockers to shape, be sure to get the exact curve of the template and that they are free from humps and hollows. When they are thoroughly dry after bending, take a small plane and round the lower edges slightly.

The completed rocker is given a coat of

the seat should run parallel to the sides, and dowel-rod supports are located under the front end of the seat and behind the upper end of the backrest; these two parts are joined together with screws.

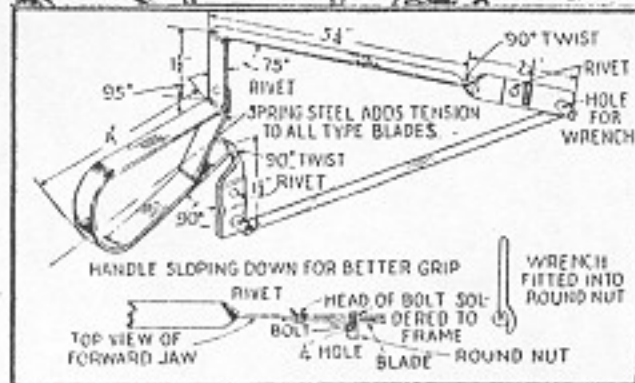
The best method of construction at this point is to fasten a cleat to the inside lower edge of the backrest to hold the rear edge of the seat, which is then screwed to the cleat. The dowel-rod supports fit holes of corresponding size drilled through the sides and are held in place by means of wood screws and washers, which latter should be larger in diameter than the holes. The tray is screwed to the sides and a dowel rod is fitted across the front just above the tray to serve as a handhold. The footrest is attached in the most convenient position for the child's feet. If desired, a dowel rod may also be run across the rear end of the



shellac and can be painted white or gray, while the saddle and bridle decorations may be of any color that suits your fancy.

Popular Mechanics
March, 1937

This Scroll Saw for Modelmakers Handles Unusual Work



Simple saw frame will hold any type blade from a jeweler's to a hack-saw blade

Holding any type of scroll-saw blade, this light frame is easy to handle, keeps the blade under strong tension and cuts into small places. It is made from a piece of sheet brass $\frac{1}{16}$ by $\frac{1}{2}$ by $24\frac{1}{2}$ in., which is bent to the shape shown and fitted with a piece of spring brass or steel riveted in place between the handles to maintain the tension on the blade.

—S. H. McElroy, Baltimore, Md.

POPULAR MECHANICS September, 1928

Darkened Brooders Stimulate Chickens' Growth

A Wisconsin poultry man has proved by repeated tests, that the growth of brooder chicks is stimulated approximately 25 per cent if the brooder is darkened a few minutes several times each day. This method is followed naturally by the mother hen, who calls her chicks to her from time to time for the same purpose. The reason

for the increased growth of the chicks when this is done, is that the temporary darkness induces them to nap and doze, which, it seems, helps to digest food previously eaten. It was formerly thought that a brooding hen did this to provide warmth for the flock but the same instinct seems to rule in hot weather.

Interested parents and their teaching devices play a large part in the "brilliance" of the young marvels of the air

As the Quiz Kids Were Bent

Reader's Digest, September 1941

Condensed from The Kiwanis Magazine

J. P. McEvoy

THE "Quiz Kid" radio program was turned down by 12 prospective sponsors. Where, they asked, would you find enough smart children to put new ones on the air week after week? They needn't have worried; the supply seems unlimited. And the investigators who select these unusual youngsters for radio competition have been impressed by the appearance in every case of one factor: back of every unusually bright child you always find an unusually interested grownup who has made it his or her job to encourage and stimulate the youngster.

This is certainly true of the half dozen Quiz Kids whose superior scores have won them the most repeat appearances. Jack Lucal, 14, has been on 31 Quiz Kid programs. When Jack was two his mother started nightly talks with him before he went to sleep. At first they reviewed the day's happenings. As he grew older they discussed famous persons in history or something one of them had been reading, or they exchanged views on current events. The family insisted that Jack consider both sides of an issue, and they subscribed to newspapers of opposing views. Whenever he expressed an opinion regarding public affairs the family took the opposite side, and Jack would have to battle it out.

Jack's mother and grandmother started early to clip from newspapers and magazines interesting and informative items which they put on his desk. Family dinner-table talk is based on these tidbits. Jack's familiarity with current history, started by the clipping service, has been augmented recently by his own collection of headlines of events which he believes will go

down in history. These are all arranged in scrapbooks on shelves, as is his collection of travel bureau pamphlets, for Jack's mother believes that every child should have a place where he can keep his collections in some organized fashion, and that parents should encourage every interest a child shows.

Quiz Kid Van Dyke Tiers, 14 and a popular high school senior, started learning geography early by playing games with his father. "I'll race you to the Galapagos Islands," the father would challenge, and they would tear across the room to a big wall map. The one who put his finger first on the correct spot won. Papa always left a jigsaw puzzle of a country or a continent lying around so Van could put it together and learn geography the while.

"As soon as he was conscious of objects I began to point out differences," says Papa Tiers. "His high chair, I explained, was made of wood, and wood came from trees; his spoon was made of silver, which was dug out of the ground. I told how the ore was mined and showed him pictures. We would examine trees and I would tell him how they grew. Then I would pick up rocks and teach him to recognize different kinds. In this way he learned a lot of botany and geology long before he knew what those words meant. He also learned not just to look at things but to *see* them. Even at three he was a careful observer. One day I asked him to describe a puppy he had seen. He said it was brown and white and pink. I asked him, 'Are you sure it was partly pink?' and Van replied, 'Yes, on the inside of its mouth.'"

When he was two and a half he had a lesson in mechanics which expanded into physiology. His

father took an alarm clock apart and showed Van how it worked. Then he pointed out why people have to have alarm clocks: they don't get enough sleep. Then he made the meaning of the word "alarm" clear. Pricking Van with a pin he explained that this was pain — a beneficial alarm which woke you not from sleep but to the fact that something was wrong.

Van went to school at seven and was put in the fifth grade. All that he knew he had learned at home, through conversations with his father, listening to discussions at the family table, and reading everything he could — he had learned to read from newspaper headlines, which he followed as his father read them aloud. "Any child of normal intelligence can learn as much if correctly taught," says Papa Tiers.

One of the outstanding Quiz Kids is 15-year-old Cynthia Cline. "I started teaching her when she was a baby," says Mrs. Cline, "by singing her to sleep with German and French songs. Without realizing it she learned entire phrases with the proper pronunciation and rhythm.

"When she was older I read poetry to her — Shelley, Keats, Chaucer, Burns. I would read a line and have Cynthia repeat it. Finally she could memorize entire poems, thus acquiring a rich vocabulary of beautiful words and an appreciation of poetic expression. Later we made up rhyming games to accompany tasks around the house — I would start with a sentence and she would supply the next one.

"I didn't encourage her to read too soon because I feel that a child with her nose in a book misses too much of a child's normal play."

To teach Cynthia to draw, she would herself draw a dog or child and let Cynthia copy it, always helping and correcting her work, never laughing at any effort. Parents often destroy children's interest in creating things, she thinks, by laughing.

"When she was a baby," says Mrs. Cline, "her father and I were separated, and her responsibilities began early." When she was three

her mother started a nursery school in their home to support them, and Cynthia soon began helping her in that. Since the age of seven she has done a deal of her own darning and mending.

Joan Bishop is the amazing 14-year-old musical expert of the program. Because she is so gifted her mother has been careful to keep her from becoming one-sided. Consequently her general information is superior to that of most children her age. She was early introduced to good literature, and to give her a background in current affairs Mrs. Bishop started her on the ponderous five volumes of *The World's Greatest Events*, bringing her from Biblical to recent times. She also has been encouraged to make good use of the dictionary and encyclopedia. But her mother thinks that more important to her background is "her early habit of reading thoroughly two newspapers every evening."

How she learned to read will be a body blow to most educators. Sunday mornings she would lie on the floor and listen to Quin Ryan read the funnies over Station WGN, studiously following him through the comic supplements oogle by oogle and pow by pow.

When 11-year-old Richard Williams, the mathematical Quiz Kid, was three his grandfather used to take him around East Chicago visiting his old cronies. This was the beginning of Dick's education, for the grandfather taught him to play rummy and keep score, and in restaurants to add up the checks before the waitress could total them. Now Dick keeps accurate ledgers on all the family trips.

Since he was three Dick has followed the schoolwork of his older brother, who gave him sympathetic coaching. Dick studied all the maps in his brother's geography, asked for more, and has seldom been without a map in his pocket. Last Christmas the family gave him what was supposed to be a complete atlas. Dick found two small countries missing; Rand McNally admitted the error and gave him another atlas.

Dick's father is a mechanical engineer, and as part of his boys' education he brings engineering problems home and asks the boys to help him solve them. As a result, Dick was doing high school math at seven and today sits at his sixth grade desk and does geometry while the class studies arithmetic. The family keeps him in his school age group so that he won't be too much out of it socially.

Mowing the lawn, weeding the garden, cleaning the basement are definite chores for both brothers, who assist their mother with the dishes on alternate nights. "They have a small allowance, but we don't pay them for household jobs," she says. "Very early they were made to realize that the house belongs to them as much as to us."

Eight-year-old Gerard Darrow, the baby Quiz Kid, learned the names (English and Latin), customs and habits of 365 birds before he was four. Gerard's mother died when he was an infant, and his Aunt Bessie has devoted every waking moment to his develop-

ment. She early started reading nature books to him — such profusely illustrated books as Frank G. Ashbrook's *Birds of America*, and the card series of the National Association of Audubon Societies. Later came *Butterflies of America* and *Bugs of America*, both by Lillian Davids Fazzini, and Jane Harvey's *Wild Flowers of America*.

In this way he was led from birds to insects and thence to rocks, shells and fish. He also started to collect abandoned birds' nests, fossils, pressed flowers, discarded feathers, and the hair of his friends.

Gerard doesn't care much for school. Wading through mud puddles and falling off his bicycle are favorite pastimes. People who would tell you that he is a mental monster don't know what an attractively normal child he is, but the children in the block could tell you.

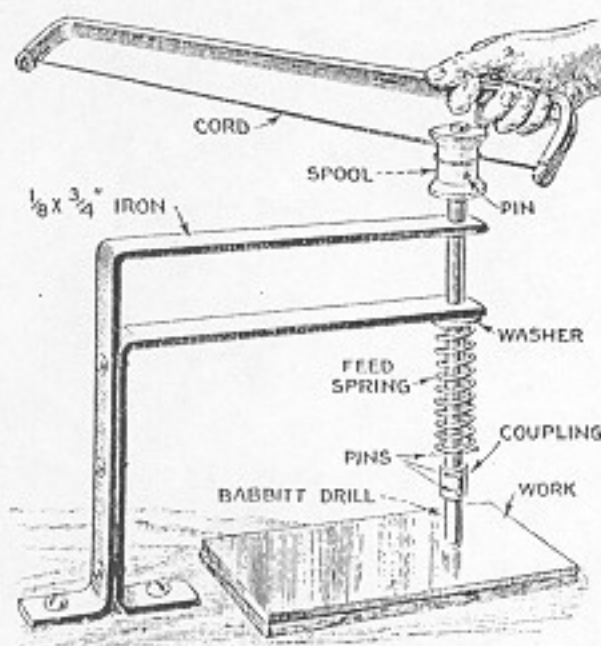
The Quiz Kids' parents stoutly maintain their children are not prodigies but the result of patient, persistent cooperation at home — something all parents can and should give their children.

Drilling Glass

While making a frictional electricity machine, I had occasion to drill several holes in glass. An ordinary hand drill was found useless for the purpose, so I devised the drill shown in the drawing. It consists of a flat-iron frame having two arms that extend horizontally, one over the other. Holes were drilled through the ends to receive a metal rod in a vertical position, the holes serving as bearings. The rod is turned by means of a bow, the cord of which is wrapped once or twice around a wooden spool driven on the end of the rod. A coupling at the lower end of the rod serves for the attachment of a drill. I used a copper drill at first, but found babbitt worked much better. The drill was fed with fine emery. A coil spring provides downward pressure. A mixture of camphor and turpentine was used as a drilling compound.

POPULAR MECHANICS

January, 1929



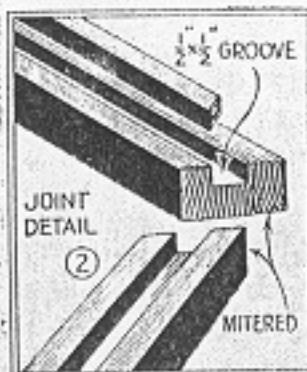
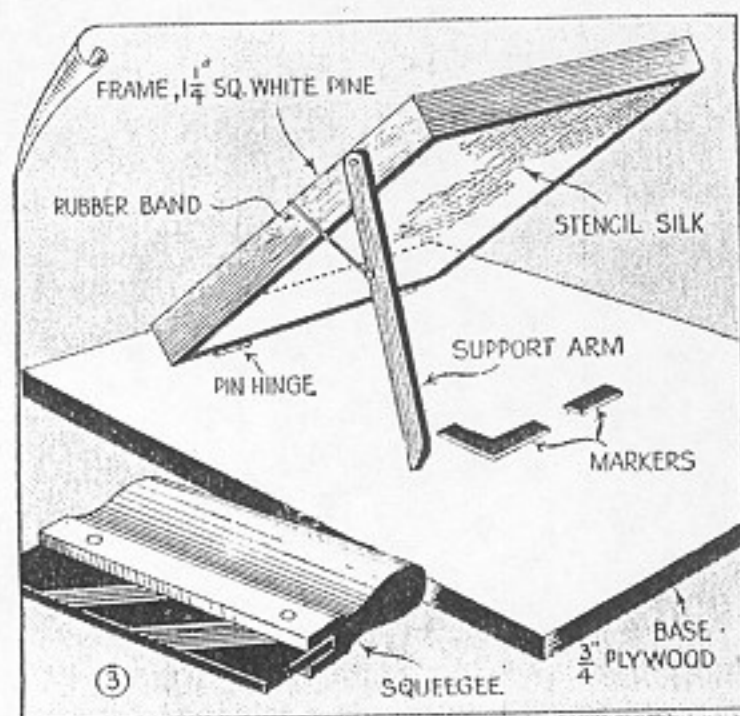
This Outfit, Actuated by Means of a Bow, Facilitates Drilling of Glass

SILK STENCILS

SIMPLER than cutting linoleum blocks, silk-screen stencils offer the home craftsman one of the fastest and cleanest methods for painting greeting cards and cutouts. Painting can be done on any flat surface, and the design can be worked on wood, cardboard, cloth, or any other material. Photographic processes simplify the art work, so that intricate designs can be reproduced easily by the average worker.

The setup is simple. As shown in Fig. 3, there is a wooden frame on which is stretched a piece of stencil silk or organdy. The

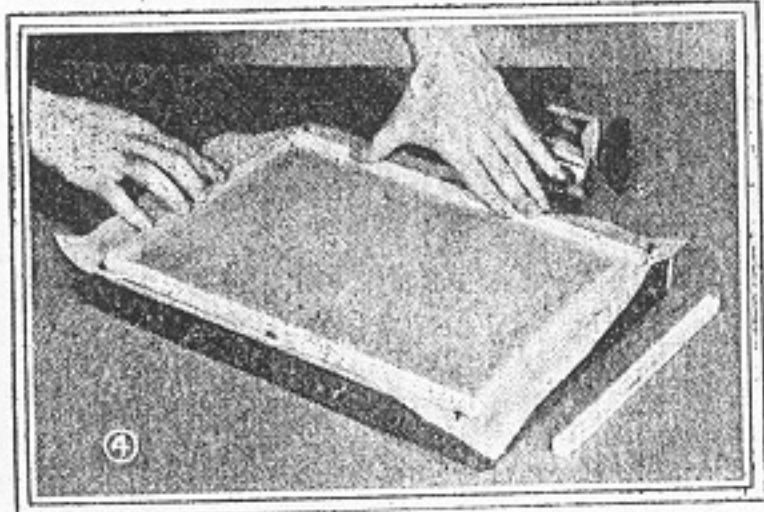
*The perfect method
for painting greeting
cards, cutouts and
novelties*

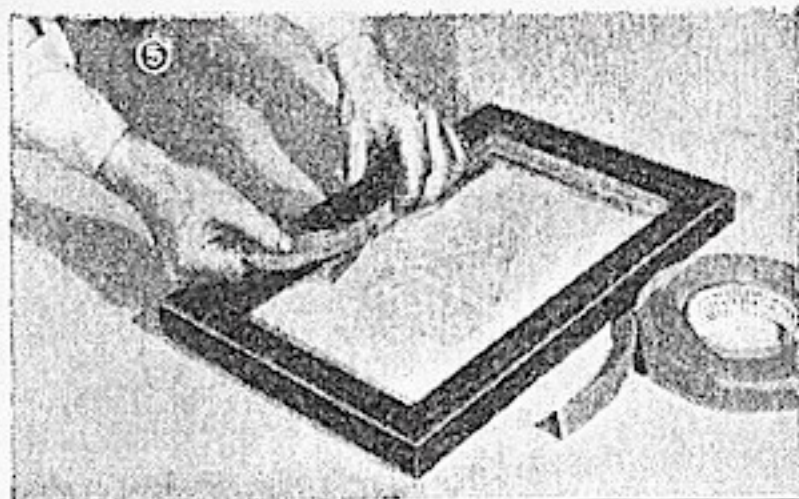


frame is hinged to a base board with two pin hinges. The design is painted or blocked out on the silk screen and is reproduced by forcing paint through the open meshes of the screen, using a rubber squeegee.

In setting up for any job, the first thing required is the wooden frame. For average-size work, this is made from 1 1/4-in. square white pine. The frame should be about 2 in. wider than the design and about 6 in. longer, inside dimensions. Frame members are mitered and grooved, as shown in the detail, Fig. 2. The stencil silk is fitted to the frame by first tacking it loosely in place; then, 1/2-in. square cleat sticks are pushed into the grooves, as shown in Fig. 4, stretching the silk drum-tight.

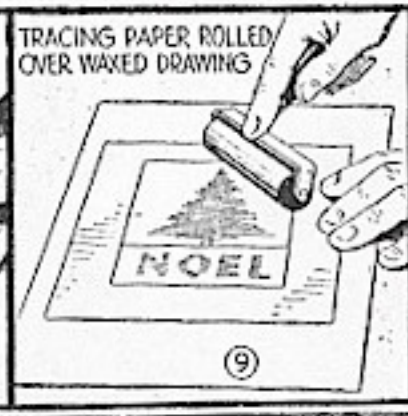
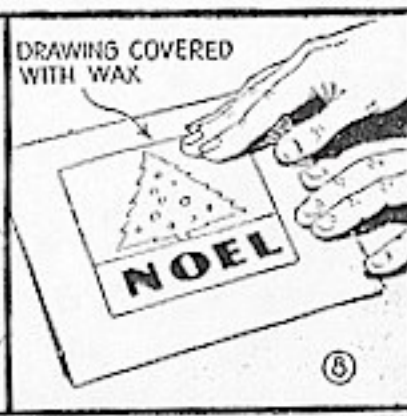
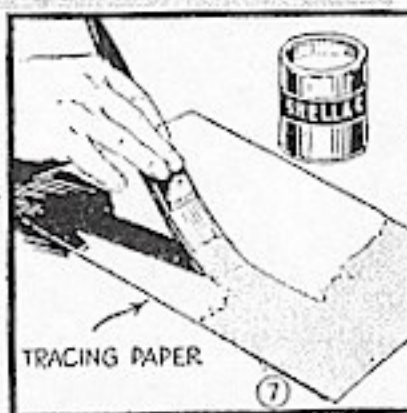
One of the simplest methods of getting the design onto the screen is the paper mask or knife-cut stencil, as shown in Figs. 5 to 13 inclusive. In the example, Fig. 6 is the copy, which is drawn full size. A sheet of tracing paper large enough to cover the screen is coated with shellac, as shown in Fig. 7. While this is drying, the copy is coated with wax, rubbing on a thin film with the fingers, as shown in Fig. 8. A good wax for this pur-



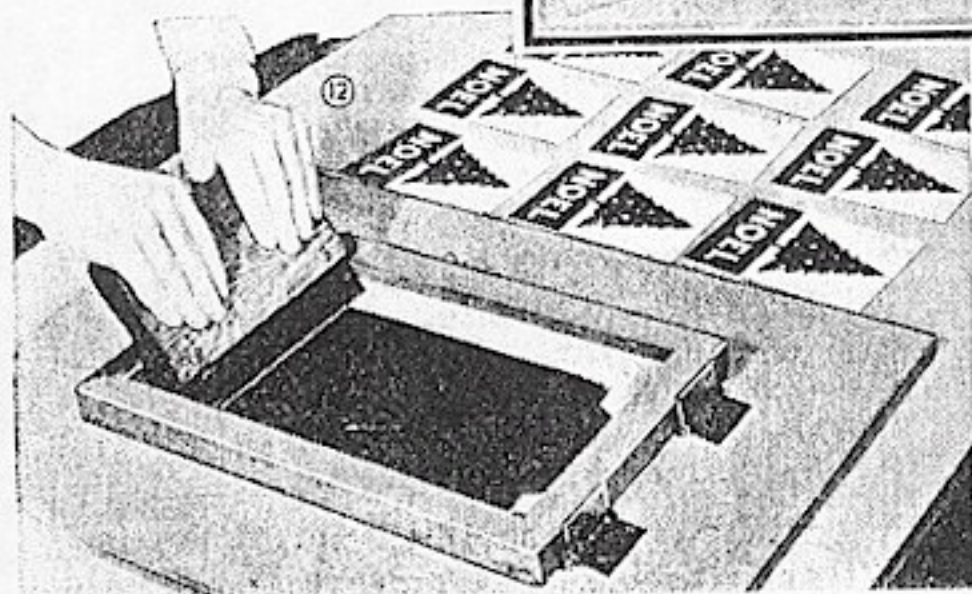
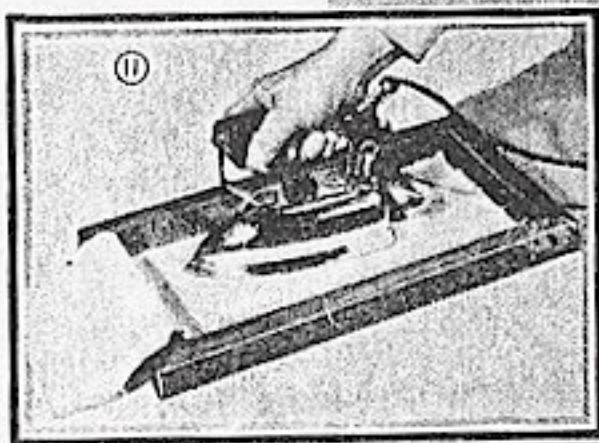
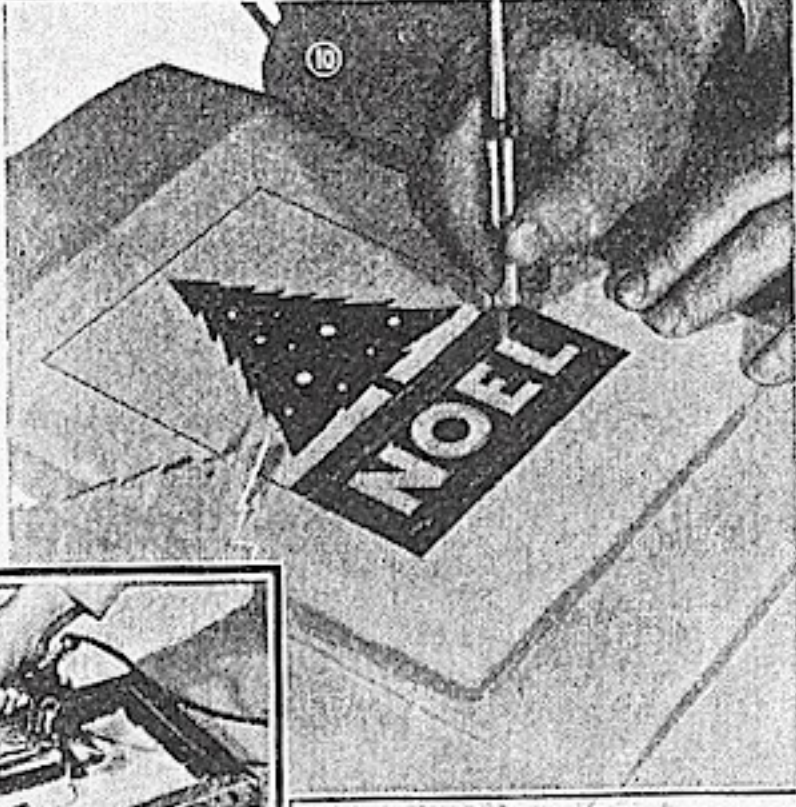


completely blocked off except for the design. Then you pour a quantity of paint onto the screen, and wipe it across the design with the squeegee, as shown in Fig. 12. Fig. 13 shows the screen in an up position, with the work in place, registered by two cardboard markers fastened to the base.

Another method of getting the design onto the screen is to block it out with a special lacquer filler. The Dutch-girl cut-



pose is made from equal parts of beeswax, kerosene and linseed oil. The tracing paper, shellacked side up, is then rolled over the waxed drawing, Fig. 9. All portions of the design which are to print are now cut out with a stencil knife or razor blade and stripped off, as shown in Fig. 10, the wax coating holding the design firmly in place. After the cutting is complete, the silk screen is placed over the design, and, using a thin, soft pressing cloth and a medium-hot iron, the design is adhered to the screen, as shown in Fig. 11. Finally, the inside edges of the screen are lined with masking tape, as shown in Fig. 5, to prevent paint from leaking through. The result is a screen



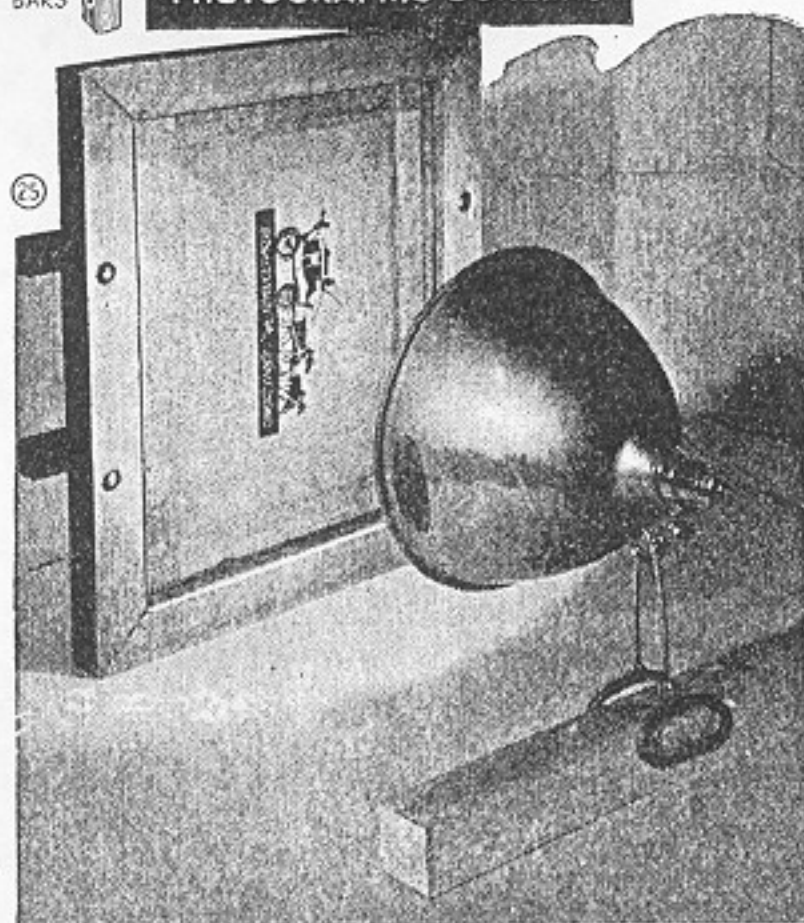
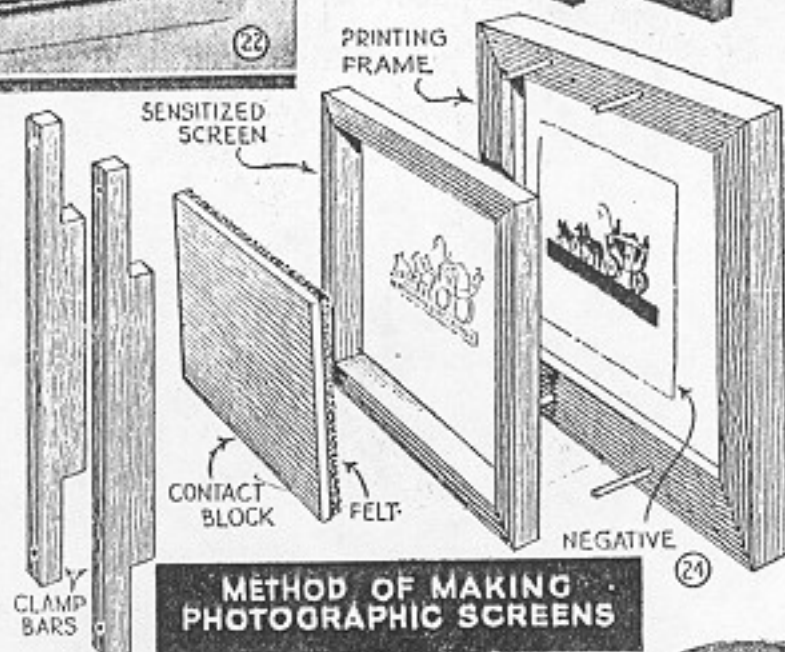
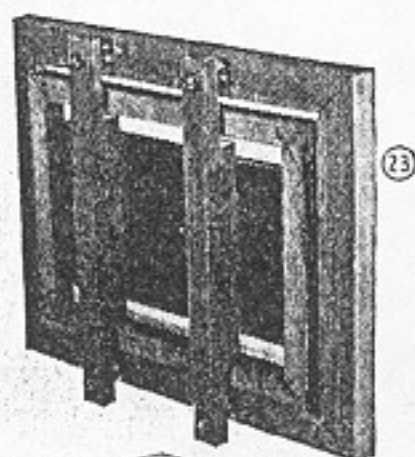


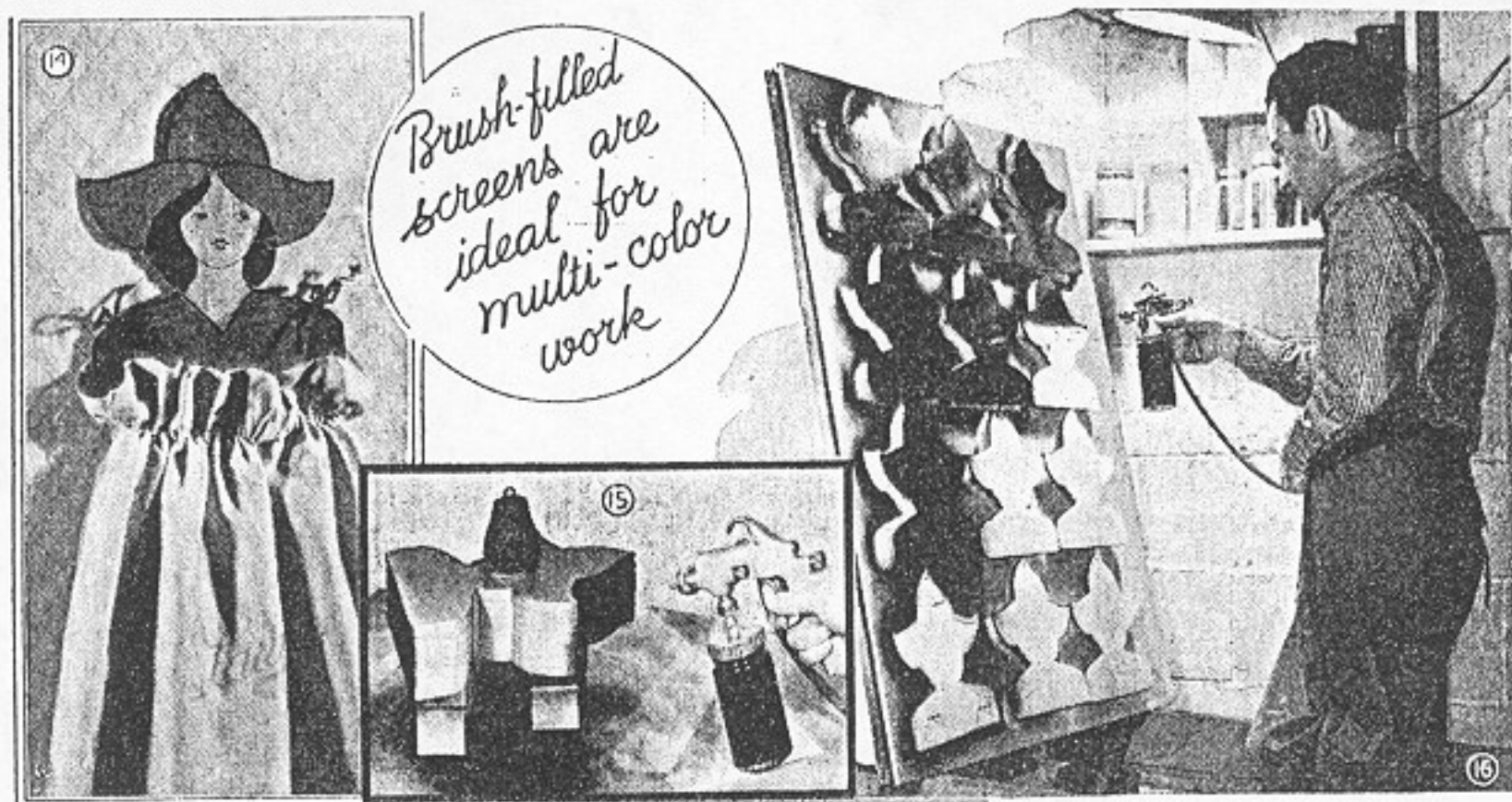
run in yellow is complete, the water filler is washed out, leaving the original lacquer-filled screen. The yellow face is then blocked off with water filler, leaving the red hat and dress open for painting, Fig. 1.

The stencil silk used for brush-filled screens is what is known as No. 16, running about 140 threads per inch. It is available in several grades. Knife-cut stencils of open design can be run on organdy. The paints used should be made especially for screen work. These are available in flat and gloss, also in a special-process lacquer, and are put up in paste form, being thinned as required with a special non-clogging varnish. Average consistency for painting on cardboard or wood should be slightly thinner than soft grease.

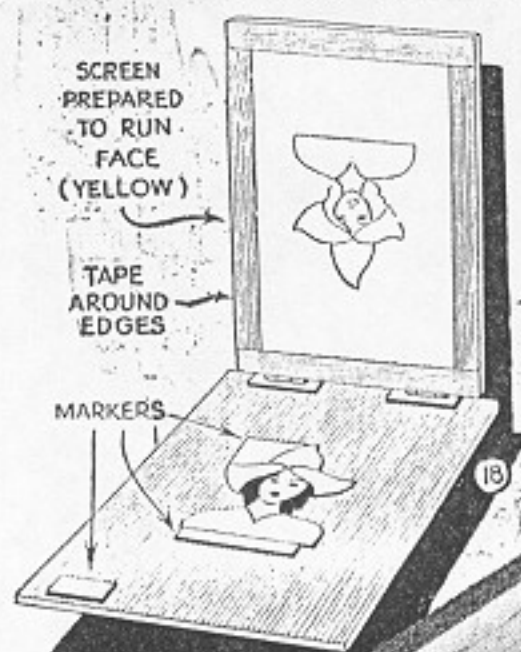
The photographic method requires no artistic ability, since the worker can copy designs directly from any book or magazine with the aid of a camera. In the example, Fig. 21 is the copy. As in any photographic process, a negative is required, that is, the copy must be transferred, in black, to a clear sheet of celluloid or tracing paper. If desired, the negative can be made by hand by placing a sheet of heavy tracing paper over the copy, as shown in Fig. 20, so that the design can be filled in with photographer's opaque or black ink. In the second method of making a negative, the copy can be made with a camera. This gives a negative which has white lines on a black ground. This first negative is then exposed to a second film, which results in a true copy of black lines on a clear ground.

So much for the negative. The next job is to sensitize the silk screen so that it can be printed just the same as a photographer prints a photograph. No. 16 stencil silk is used. The sensitizer can be purchased from any process supply house, and requires

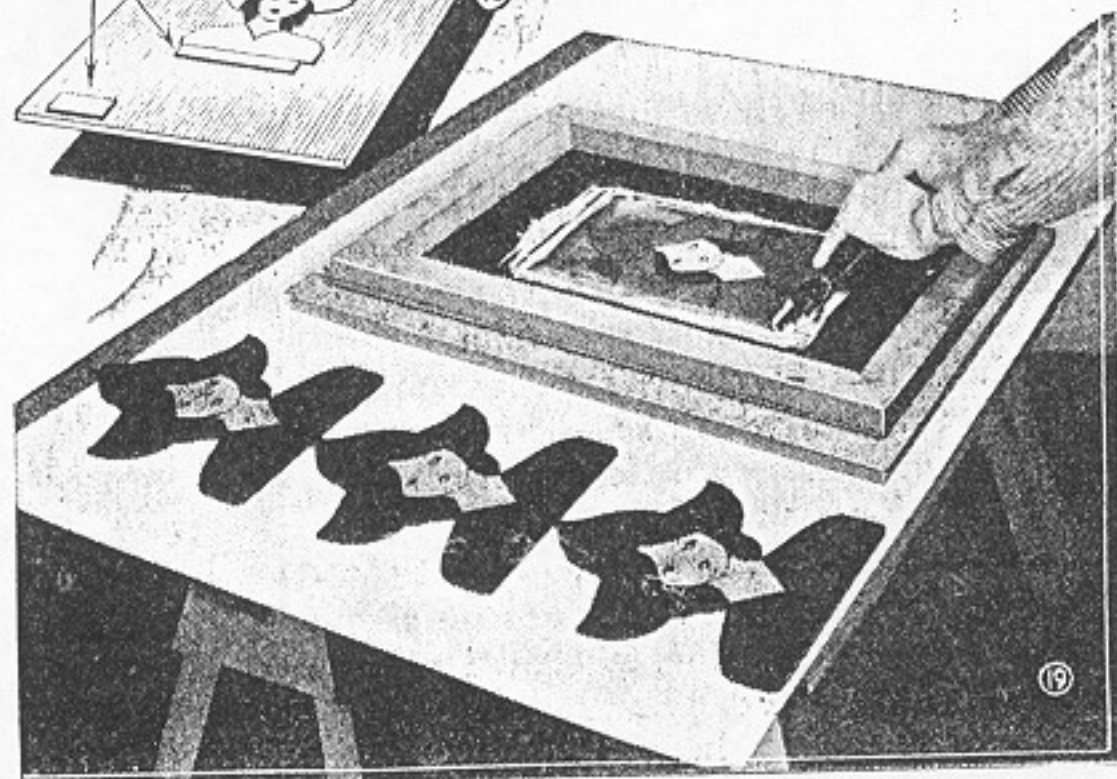


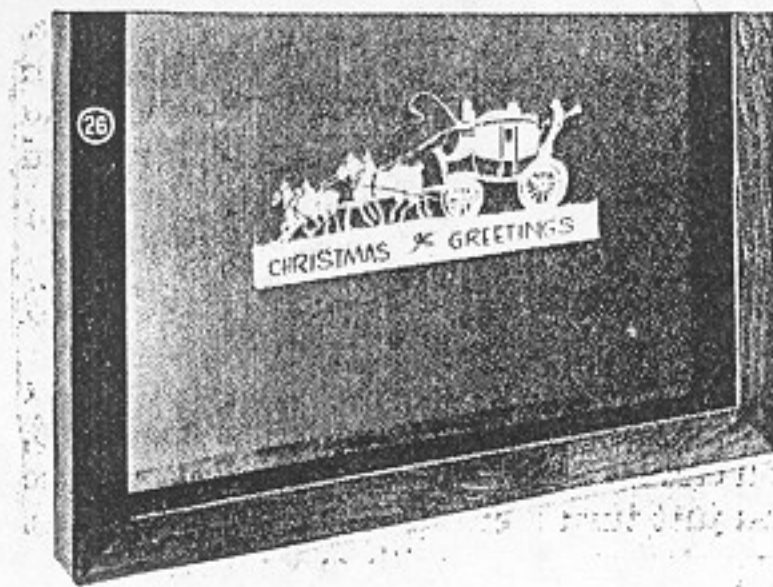


out for the top of a laundry bag, Fig. 14, is an example. Start, as before, by making a full-size copy of the design. Transfer the outline of the design to $\frac{1}{4}$ -in. plywood or wallboard and cut out the required number on the band saw or scroll saw. Stack the cutouts on edge and spray with black paint, as shown in Fig. 15, then, spray or paint the faces of the cutouts, as in Fig. 16. In the example, however, the first step is to secure an all-black cutout. The second is to make the screen, which is done by placing the screen over the copy, as in Fig. 17. The design, which is plainly visible through the silk, is then traced with a medium-hard pencil and painted with the lacquer filler. Since the cutout is already black, we will not want any of the black in the design to print. Hence, everything that is black on the copy is filled in with lacquer on the



screen, also, all the area outside the design is blocked off, as shown by the black in Fig. 18. This design is in two colors, yellow face and red hat and dress. The yellow is printed first, and, in order to protect the red, all the red areas are blocked out. This is done with a filler which is soluble in water. In Fig. 18, the gray portions of the design represent water filler. Thus, only the yellow face is left open, and this is painted on the black cutout, as shown in Fig. 19. After the



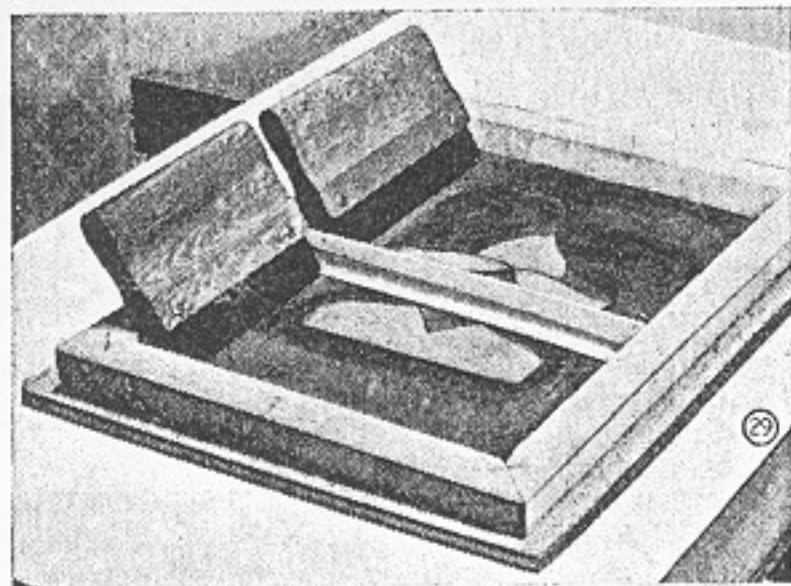
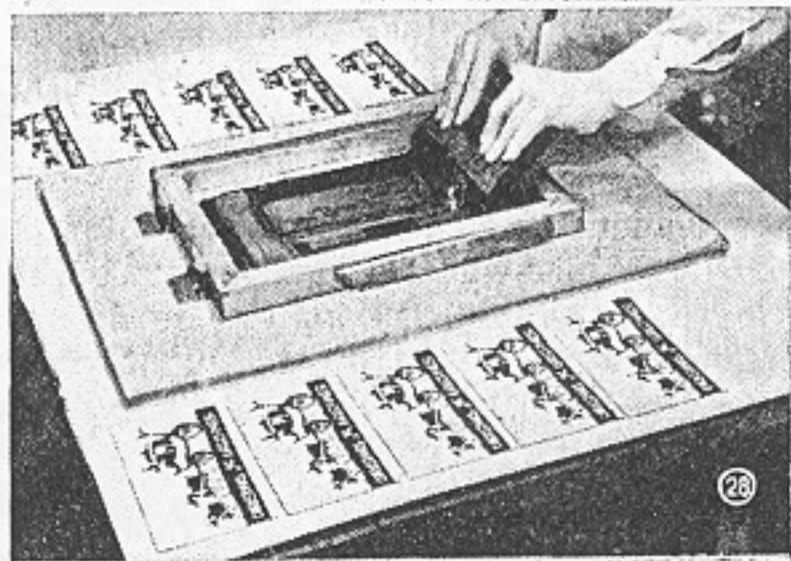


only mixing with water to make it ready. The solution is flowed on over the face of the screen, as shown in Fig. 22. All operations can be done in ordinary room light except the drying of the sensitized screen, requiring about 30 min., which should be in a darkened room. After the screen is dry, the print can be made. This is done just the same as printing a photograph, Fig. 24 showing the setup. The negative is placed face up (reading position) on the glass in the printing frame. The silk screen, face down, is then placed over the negative, followed by a contact block and clamps. Fig. 23 shows the frame ready for printing, while Fig. 25 shows the exposure being made, using a photoflood lamp. Exposure time is approximately 15 min., and has the effect of hardening the exposed portions of the screen. After printing, the screen is held under a stream of warm water, Fig. 27, which washes out the soft, protected parts of the design. Fig. 26 shows the finished photographic screen; Fig. 28 shows the job being run. While the example shows printing in one color only, as many colors as desired can be run by blocking out with water filler as previously described.

A useful dodge which can be used to advantage for certain types of two-color work is shown in Fig. 29. The copy is the Dutch girl previously shown, but in this case the hat is to be red and the dress blue. By fastening a cardboard bridge to the screen with masking tape and using two squeegees, both the red and the blue can be run at one time. Another method of multi-color printing is the elimination process. Using the Dutch girl again for an example, the first run would paint the hat, face and dress in red. The red hat and



AFTER PRINTING, THE SCREEN IS HELD UNDER HOT WATER TO BRING OUT THE PICTURE-LEFT

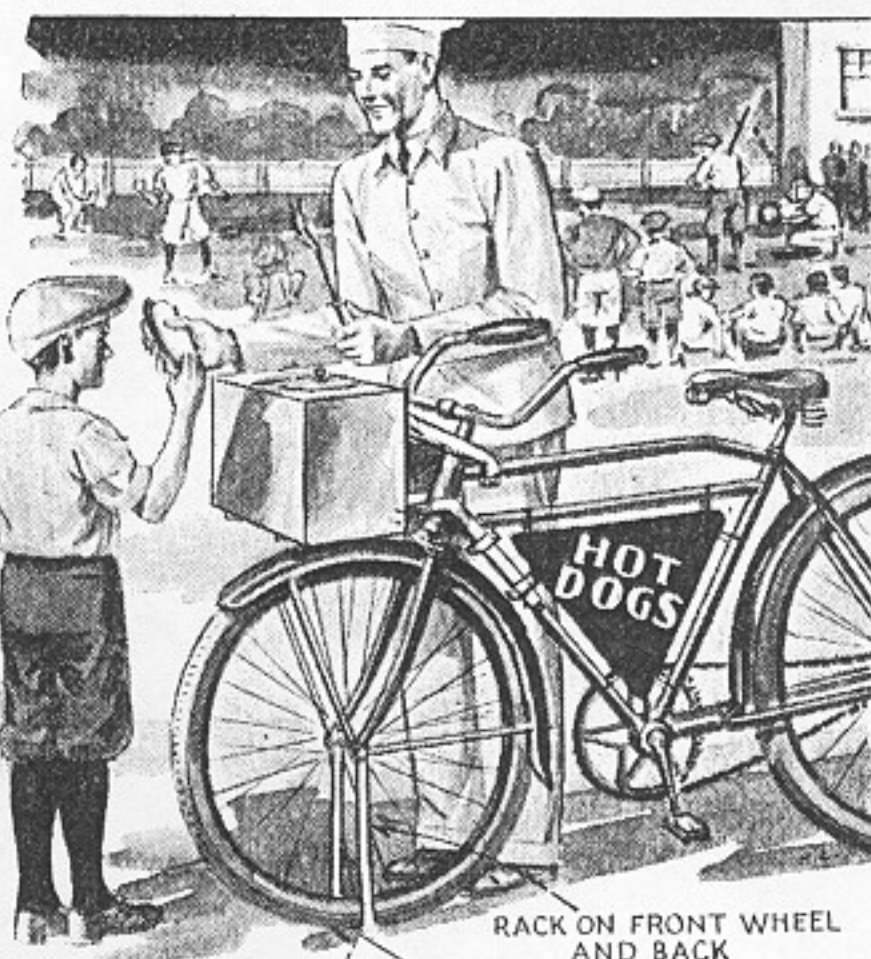
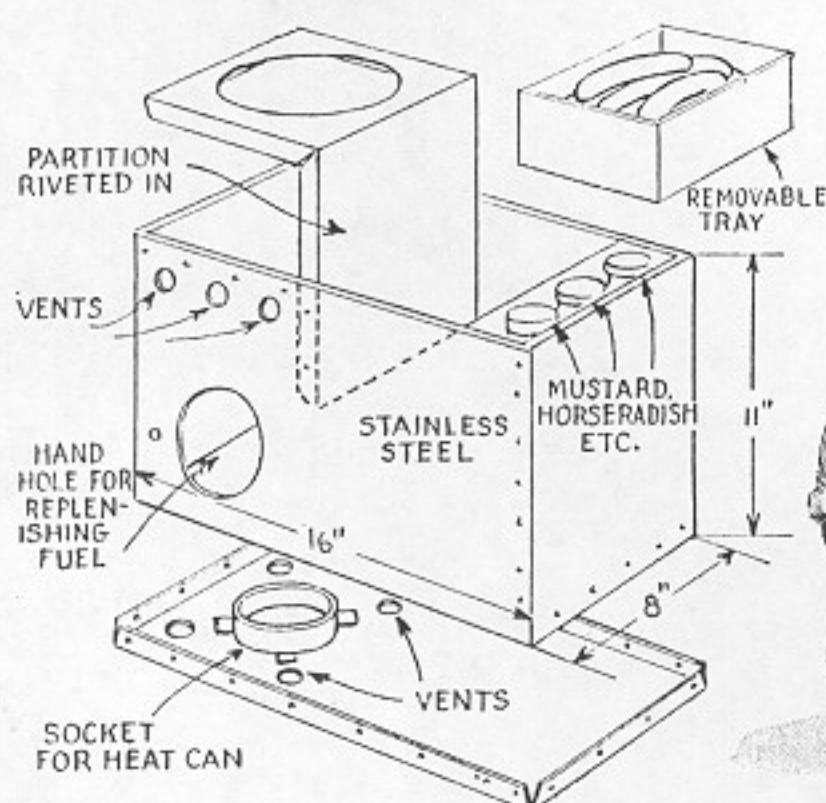


dress would then be blocked out, leaving only the face which would be run in yellow. Then, if desired, the face could be blocked out, leaving only the eyes to print in blue.

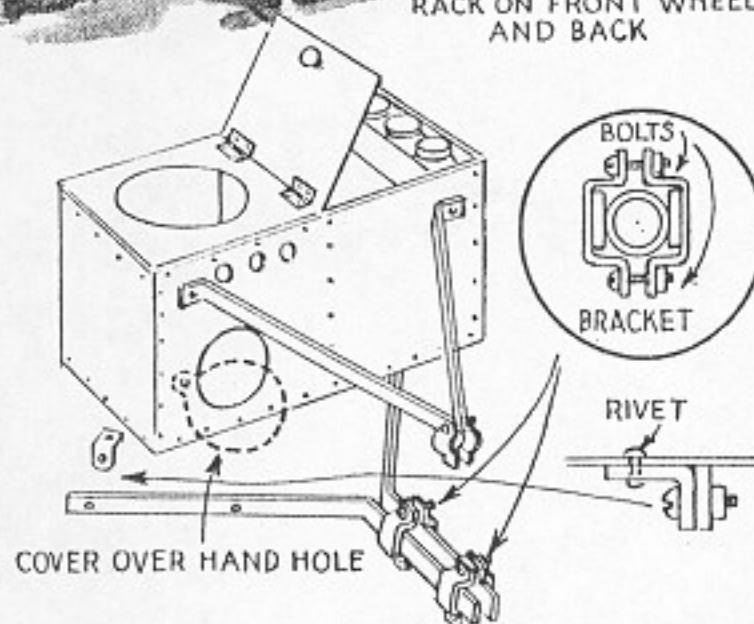
☞ Dipping a rubber eraser in emery powder will make it suitable for cleaning rusted or corroded metal surfaces quickly.

Popular Mechanics July, 1939

Hot-Dog Dispensing Cabinet for a Bicycle



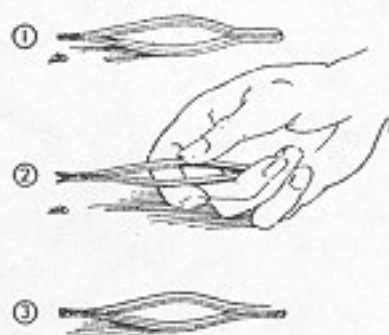
Compactly assembled of metal, this hot-dog dispensing cabinet is carried in a convenient position on the front of a bicycle. The cabinet is made of galvanized sheet iron or stainless steel, and all joints are riveted. Canned heat or a small alcohol lamp is recommended for fuel, which is replenished through a handhole in the back. A partition prevents fumes from entering the compartment where rolls and uncooked frankfurters are stored. No dimensions are given for the flat-iron frames as these must be made to fit the individual bicycle. The frame members should be wrapped with tape before bolting on the bicycle to prevent marring the finish.



POPULAR MECHANICS August, 1931

A Self-Gripping Pair of Tweezers

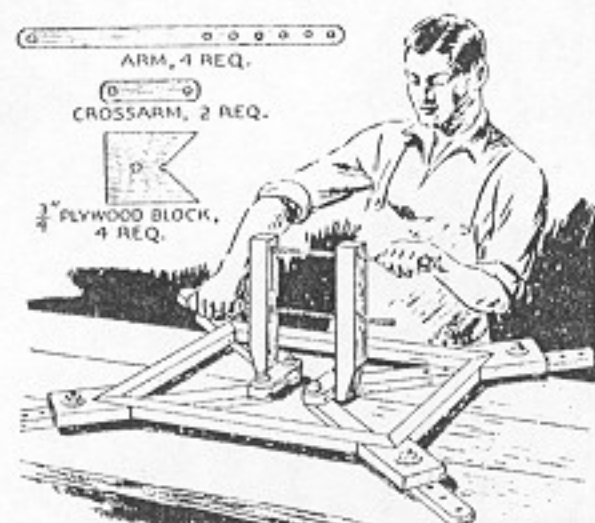
For those who handle small screws and parts, these self-gripping tweezers will be found convenient. A length of spring steel or brass is bent to the shape shown. By pressing the tweezers, the points are opened and will automatically close when the pressure is released.



POPULAR MECHANICS December, 1933

Clamp for Gluing Up Picture Frames

Gluing mitered picture frames is an easy job with this simple clamp, which pulls the joints tightly together and holds them in perfect alignment until the glue dries. To make the clamp, you will need four plywood blocks having 90° notches cut in one side, two short crossarms and four longer arms, the lengths of which depend on the size of the work. In use, each corner of the frame to be glued is placed in the notched blocks as shown, after which it is pulled tight with a clamp placed over the crossarms, taking care not to crush the corner of the frame.

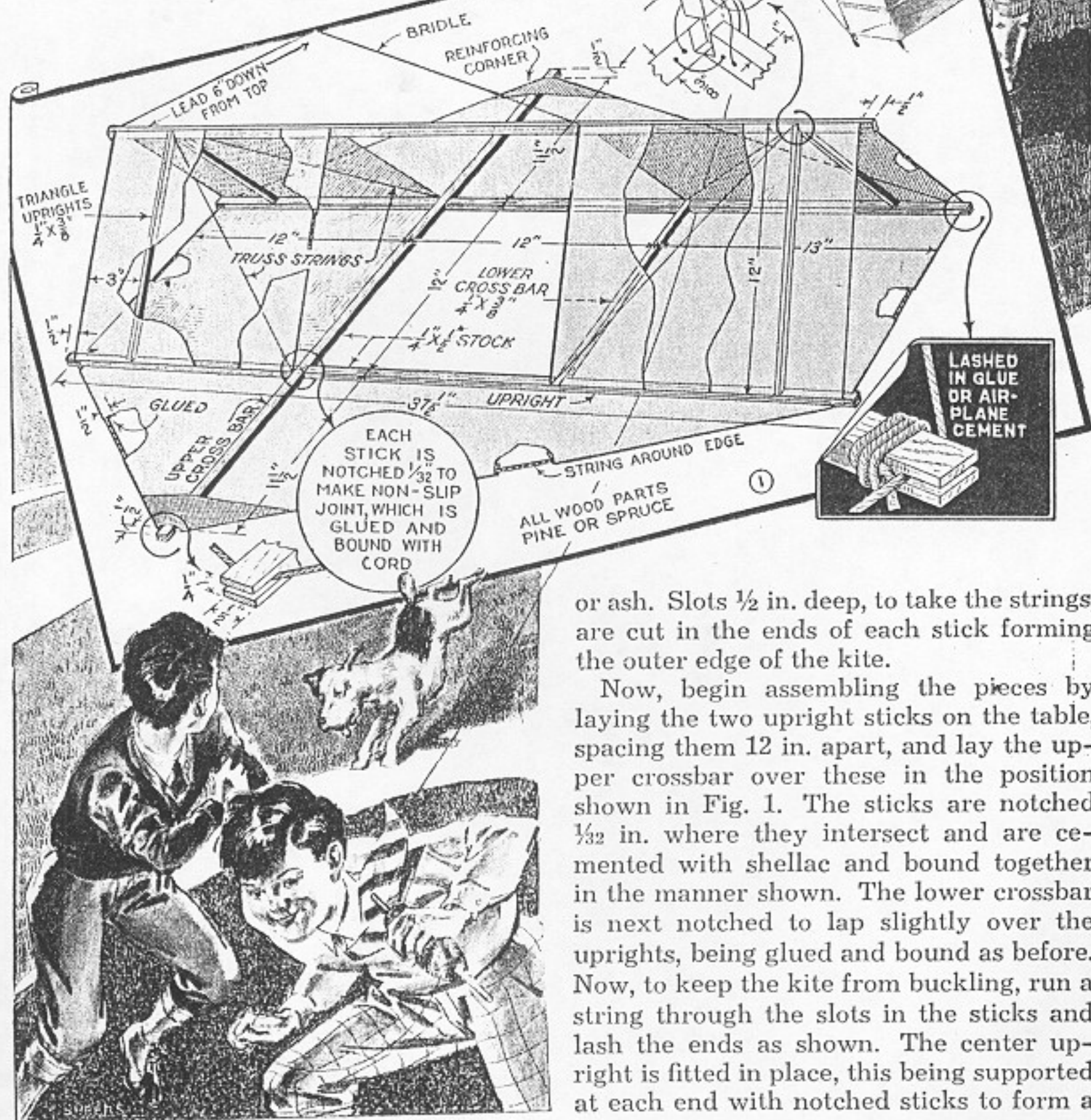


Glued Joints of Mitered Frames Held Tightly in Perfect Alignment with This Clamp

It's KITE TIME again!

POPULAR MECHANICS May, 1939

REQUIRING no tails to balance them in flight, here are three easy-to-make kites which will give you a lot of fun both in constructing and flying them. While dimensions given for the French war kite, Fig. 1, should be followed closely to assure perfect balance, the kite can be made any size provided the dimensions are increased proportionately. The sticks should be lightweight wood such as bass, pine, spruce

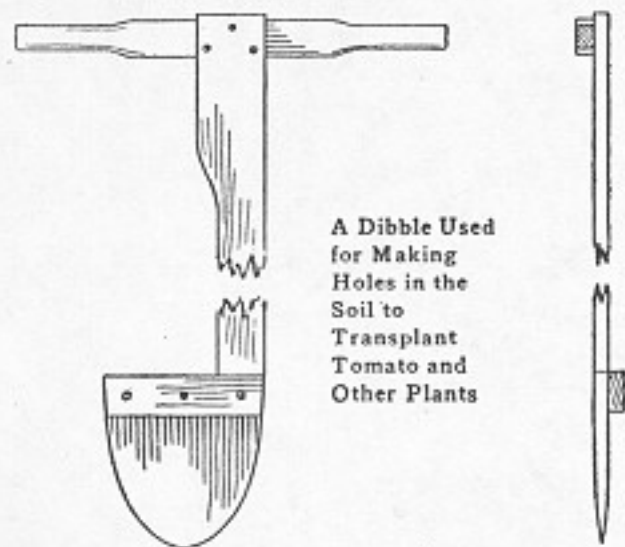


or ash. Slots $\frac{1}{2}$ in. deep, to take the strings, are cut in the ends of each stick forming the outer edge of the kite.

Now, begin assembling the pieces by laying the two upright sticks on the table, spacing them 12 in. apart, and lay the upper crossbar over these in the position shown in Fig. 1. The sticks are notched $\frac{1}{32}$ in. where they intersect and are cemented with shellac and bound together in the manner shown. The lower crossbar is next notched to lap slightly over the uprights, being glued and bound as before. Now, to keep the kite from buckling, run a string through the slots in the sticks and lash the ends as shown. The center upright is fitted in place, this being supported at each end with notched sticks to form a

A Homemade Dibble

A dibble made of a round and sharp-pointed stick is the usual tool for making holes when setting tomato and other plants. I found by experience that a dibble made of a flat board would work much better and leave a



A Dibble Used for Making Holes in the Soil to Transplant Tomato and Other Plants

cleaner hole if worked into the earth with a horizontal swinging motion. The hole produced is just right for the plant. The illustration shows its construction.

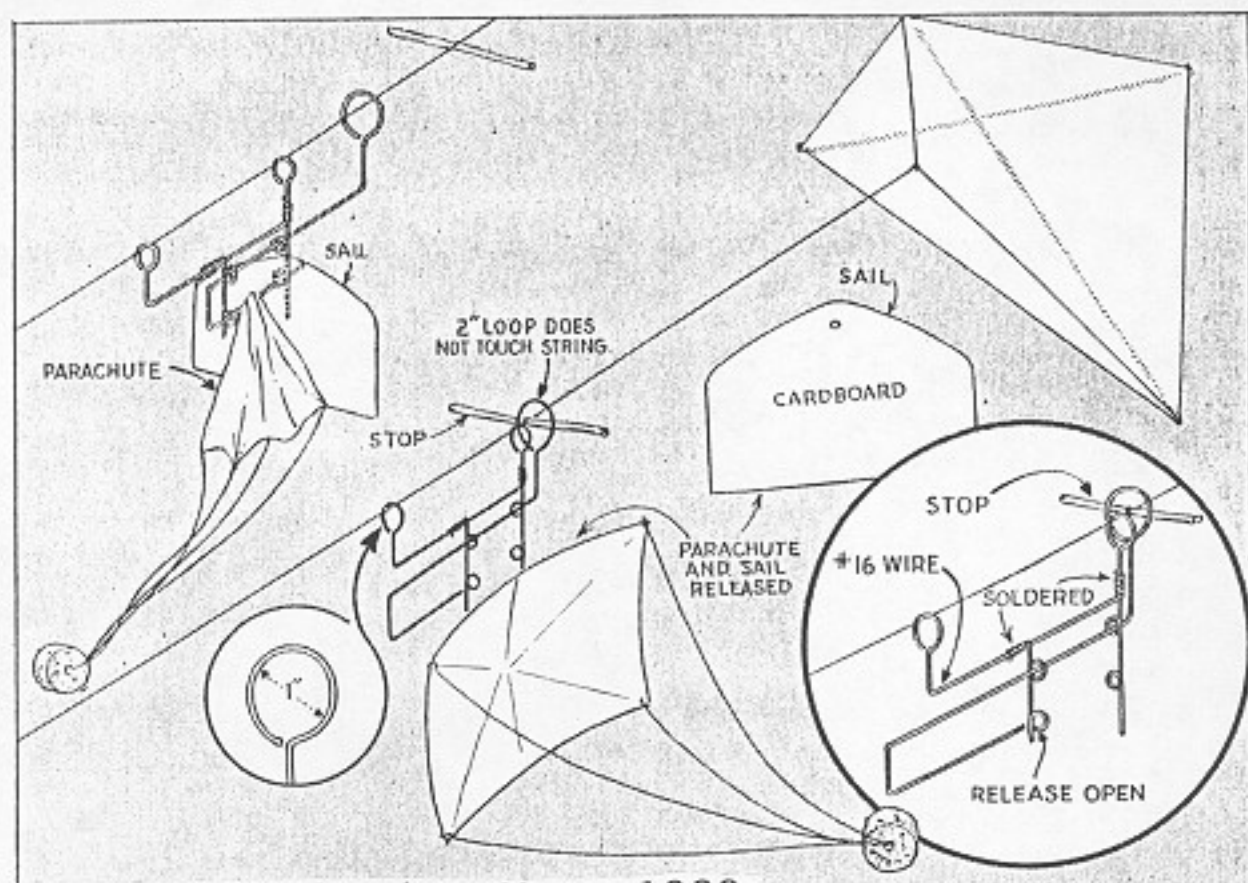
Popular Mechanics 1949

Small Frame That Sifts Materials Has Interchangeable Screens



For the person who has occasion to mix small amounts of concrete now and then, this sifter frame with interchangeable screens is handy and will handle several grades of material. The sides can be of any suitable dimensions, with a slot cut near the bottom of one for insertion and removal of the screens. Guides or slots in the other sides will hold the screen in place. A doorstop, upper right-hand detail, locks the screen in place. For average work, a coarse, medium and fine-mesh screen will do.

Dropping Parachutes Adds Zest to Kite Flying



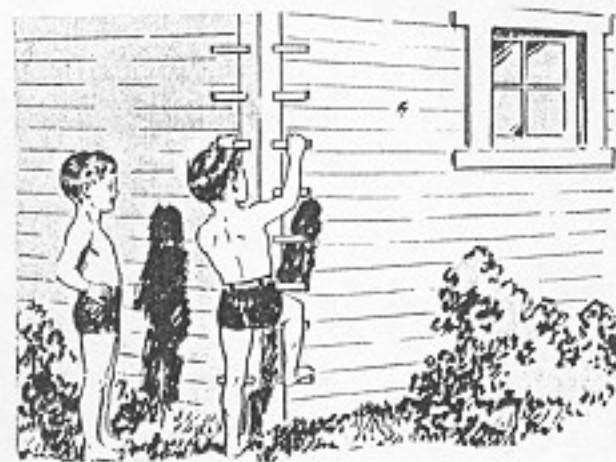
Popular Mechanics May, 1939

Parachutes carried up to a lofty kite and automatically released when the carrier hits a cross stick tied in the kite line, will keep up a lively interest. The carrier must be lightweight and there should be very little friction on the line so that ascent of the carrier will not be impeded. A cardboard sail and a parachute are held on a sliding member, which is pushed back when it strikes the cross stick, releasing

both sail and parachute. By carefully going over all of the details you will readily see how the releasing device works. While you can make it from aluminum wire, if readily available, ordinary No. 16-gauge iron wire should not be too heavy. Be sure that the sliding parts work easily yet will not shift without the proper impulse. You will have to experiment with the sail to get a cardboard of the proper size.

Sun Deck on Garage Reached by Novel Corner Ladder

Easy access to the top of a flat-roof garage, which was utilized by children as a sun deck, was made possible by means of an improvised ladder consisting of 14-in. lengths of 1-in. dowel stuck through holes bored in the corner as shown. A small nail was driven into each dowel to keep it in position. This was found much safer than a separate ladder and also much neater in appearance. If at any time the dowel corner ladder would fall into disuse, it would serve nicely as a corner trellis for climbing vines and flowers.



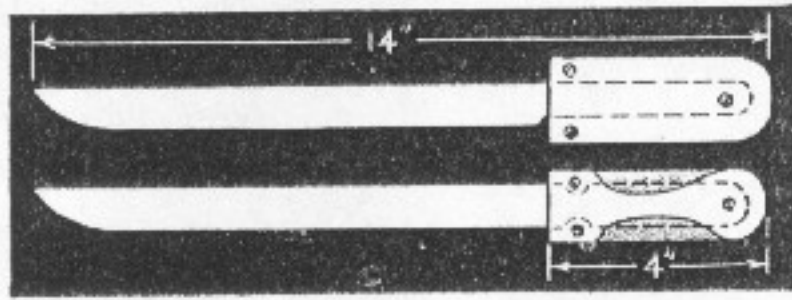
Popular Mechanics
August, 1931

Lifelike Food for Aquarium Pets

Aquarium pets such as turtles, frogs, etc., that are kept in the garden aquarium can be "fooled" into eating and kept alive for some time. Many of these creatures will only take food that is apparently alive and kicking. Cut a piece of lean, fresh beef into small pieces so that the animal can swallow it. Draw a length of thread

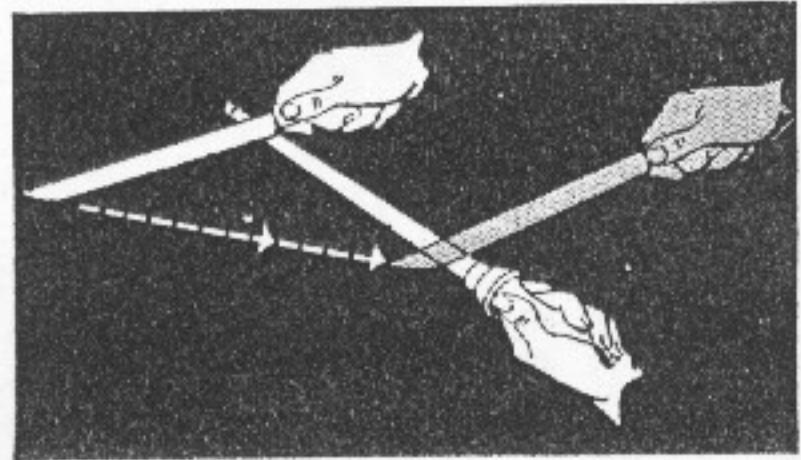
through a piece with a needle, but do not tie a knot in the end of the thread, so that it can readily be pulled out again. Swing the bait back and forth in front of the animal. If hungry, it will immediately take the food, after which the thread can be slowly removed. Turtles, salamanders and newts will take meat in this way, and also some of the snakes. Pets fed in this manner will soon learn to come up to the edge of the aquarium when you approach and wait for the swinging bait. It is a good idea to substitute a piece of liver now and then for the beef.

Popular Science April, 1943



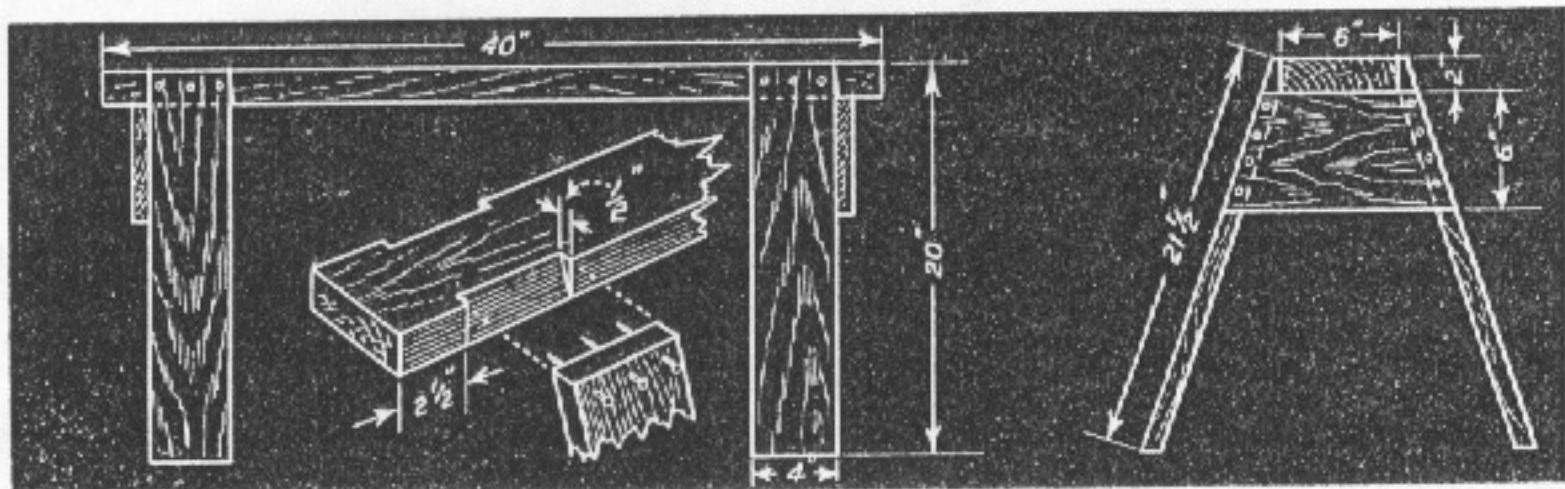
KNIVES THAT WILL STAY SHARP are often costly, but one can be made from a discarded power hack-saw blade that will cut through gristle and bone and still keep an edge keen enough for slicing hot bread. An old blade may be obtained from a machine shop, foundry, or large garage, but get one that is all hard, not one with a soft back. Grind off and taper one end, as shown; then grind the cutting edge slowly so that it does not burn. Grind the butt narrower or notch it for the handle rivets as shown, and sandwich the blade between two shaped pieces of wood, filling the crack with composition wood.

SHARPENING A KNIFE on an ordinary kitchen stone or steel requires a simple technique that is easy to learn. Keeping the cutting edge foremost and the blade tilted slightly, so that it will retain its bevel, start the stroke at the "heel" and sweep downward diagonally to cover the entire length from heel to point in one stroke. Alternate strokes from one side of the blade to the other, and do not use much pressure.



THE MECHANICAL PACKAGE MAGAZINE 1932

How to Put a Sawhorse Together to Stay



This plan shows a standard carpenter's sawhorse as built by "old timers" who put things together to stay. The mortises keep the legs rigid and secure, make the horse stiff and durable.

HOW many men know how to make a good sawhorse—the real kind, one that will stay together, carry loads and stand some knocking about? Not many know the trick. Your old-time carpenter knows that the legs have to be mortised into the back of the horse with fairly heavy cheek pieces used under the back to produce a horse like that. Here's just such a plan.

Materials Needed

For the top a piece of fir $3\frac{1}{2}$ ft. x 6" will be needed. The legs are of 1"x4" fir 22" long and four of them will be needed. And the material for the shelves or cheek pieces is of inch stuff which may be found in most any scrap pile.

The first operation is, of course, the dressing

of the backbone. A Stanley "Bailey" type jack plane or medium sized plane will take the fir down nicely. In planing fir at the workbench, a light cut and a firm stroke straight along the grain is the "technique" to employ. Then the marking of the mortises comes next.

Use of Saw

The legs and cheek pieces are of course simple matters of dressing to size and drilling for the screws. In sawing the mortises for the legs however, the cut is taken to the inside of the line, and a chisel used to dress the face of the mortise. In sawing the cut failure to make good edges results from applying the sawing force in a plane not parallel to the cut. Screws complete the fastenings and the horse is done.

SMALL PELTS TANNED

at home by simplified process

POPULAR MECHANICS October, 1939

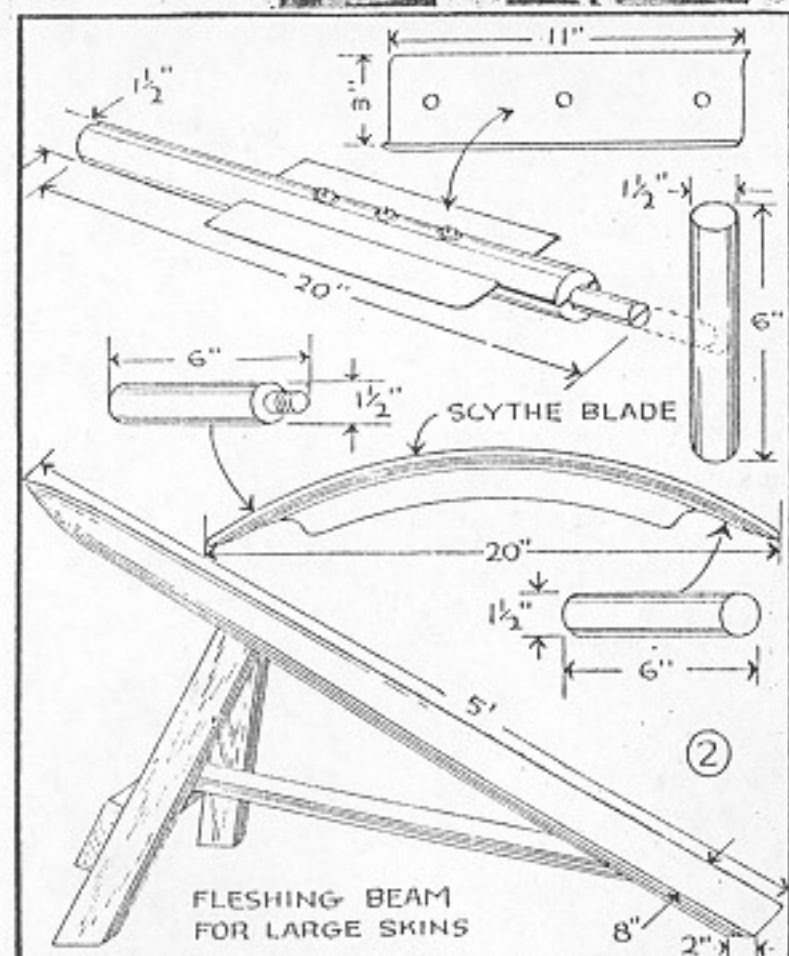
By John William Moyer

Staff Taxidermist
Field Museum of Natural History

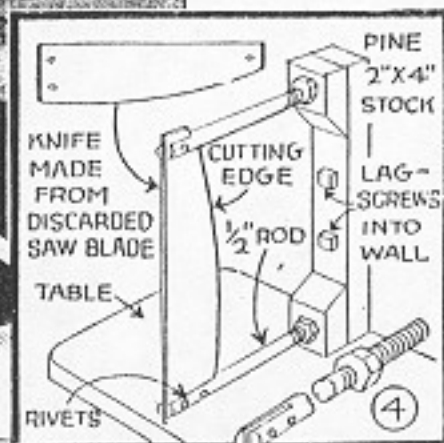
ALTHOUGH there are no tricky formulas or involved processes to bother with when tanning a skin by hand methods, the procedure takes work. What you're after is soft, pliable leather and, once the pelt is put through the tanning solution, it is the plain labor of "beaming" and "tubbing" that produces the softness and pliability characteristic of a first-class job of tanning. The tools one will require are not many and can be made, or bought very cheaply from taxidermy supply houses. Fig. 2 shows the essential tools. They are the currier's knife, a fleshing knife and a fleshing beam for the medium and larger skins. In addition you will likely need two skinning knives and a small shaving beam.

A currier's knife can be made from an old saw blade as in the upper details in Fig. 2. Have it ground down until rectangular in shape with two cutting edges. These should be ground razor-sharp and with wide bevels. Drill three holes along the centerline of the blade. Then round a 20-in. length of hardwood to about 1½-in. diameter, and another piece to the same diameter and 9 in. in length. Bore a ¾-in. hole transversely through the center of the shorter piece. Form a ¾ by 1½-in. dowel on one end of the longer piece and then slit the latter with a hand saw, from one end straight through the center to a point within about 6 in. of the opposite end. Drive the handle over the dowel and pin or rivet it in place. Slip the blade in the slot, bore holes and fasten with small stove bolts. Then wind the slotted end of the handle with cord to make a comfortable handhold. Finally, turn both cutting edges with a large knife steel in the same way that you would turn the edge of a floor or cabinet scraper.

Skins are first shaved down on a fleshing beam to prepare them for the tanning solution



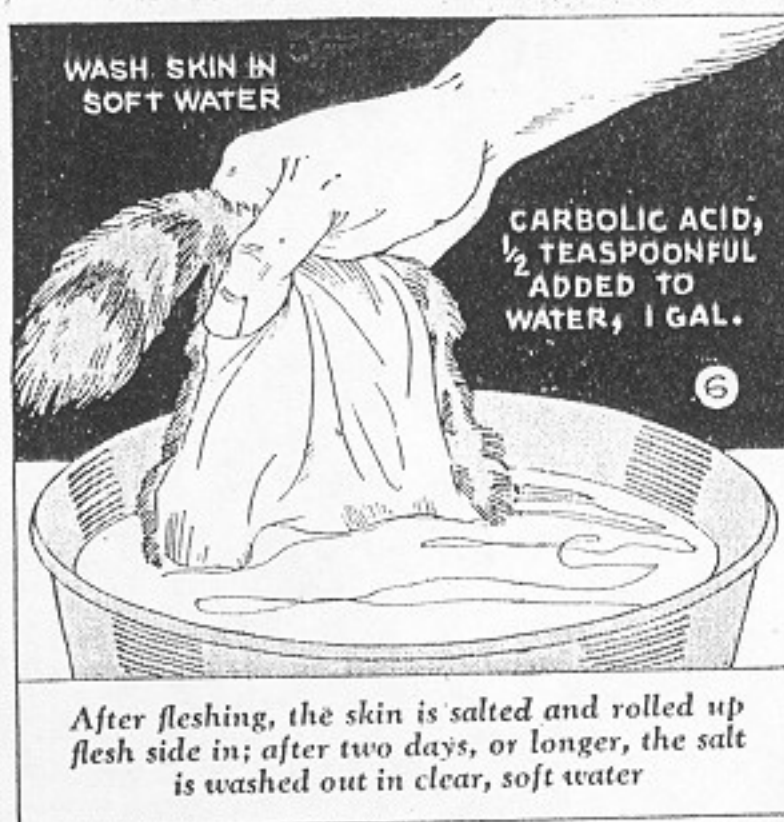
Here are the essential tools you need for preparing the skin



A suitable fleshing knife can be made from an old scythe blade cut down to about 20 in. in length. Have the blacksmith shape a shank at each end so that the blade can be fitted with wooden handles. Bind the latter at the ferrules with fine wire to prevent splitting. The two knives just described are for the shaving of fairly large skins but for the smaller ones such as muskrat, mink, weasel or skunk an upright fleshing knife such as that shown in Figs. 3 and 4 is more suitable. This knife can be purchased or can be made from an old saw blade by filing off the teeth and grinding and honing the edge. The knife should be supported on a bench in the manner shown in Fig. 4, or it can be bolted to a wall.

Before the actual tanning of skins can be started, one will have to make two fleshing beams to rest the skins on while shaving down the flesh side. A small shaving beam can be whittled from a length of hardwood 12 in. long and about 3 in. wide. Shape the end to a blunt point and round over the top side so that the skin will slide easily while being worked. The larger skins are shaved down on the large fleshing beam as in Fig. 1. The upper end of this beam should be rounded over and smoothed and the edges rounded over the full length.

The purpose of shaving or fleshing, as it is called, is to remove cartilage, fat and flesh from the skin so that the tanning solution can take full effect. As soon as the skin is removed from the carcass the ears, nose and lips must be opened up. This is very important, as the solution will not act on these parts unless they are carefully skinned out. This done the skin is immediately salted down with common salt, and rolled up, flesh side in, Fig. 5. Leave it rolled up for at least a couple days. Then it is washed out in clear, soft water and hung up to drain, Fig. 6. Skins that become dry after salting should be soaked until pliable by immersing them in soft water to which a few drops of carbolic acid have been added, about $\frac{1}{2}$ teaspoonful to the gallon of water. Smaller skins can be shaved down with a small skinning knife, or the upright knife can be used as in Fig.

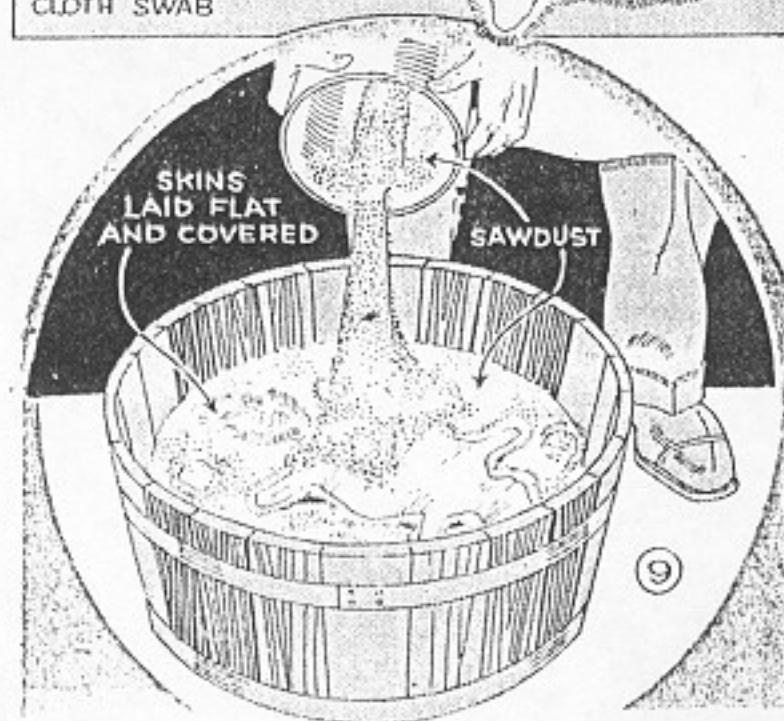
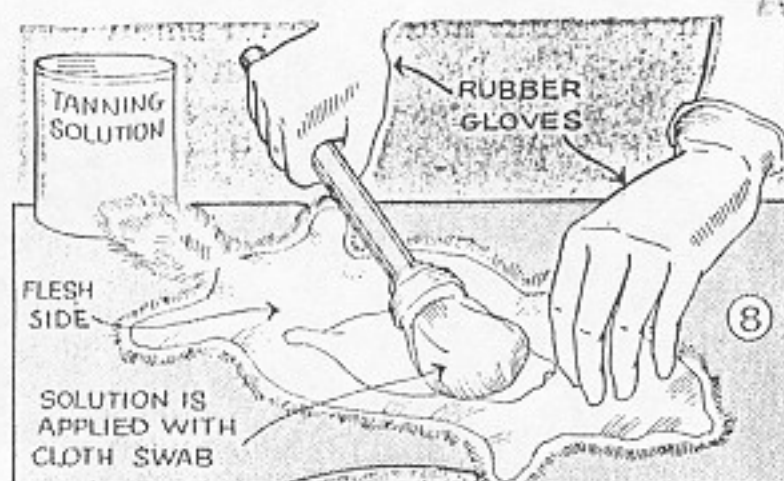


3. In working the larger skins the currier's knife is used. Notice in Fig. 1 the proper way to hold the knife. This is important, for if the knife is not held correctly, one is likely to cut holes in the skins. It is also necessary to be very careful not to shave the skin down too thin as this will cut off the hair roots, causing the hair to fall out during the process later. While fleshing or shaving, the knife will become dull and must be sharpened quite often, and the edge turned each time with the steel.

After the skin has been shaved to the proper thickness, it should be beamed lightly as in Fig. 7, then stretched flat on the floor, flesh side up, and swabbed over with a solution of tanning liquor, Fig. 8. To make the liquor, bring water, 1 gal., to the boiling point. Then add salt, 1 quart, and stir until thoroughly dissolved. Finally add sulphuric acid, 1½ oz. by measure, slowly to the salt solution. Allow the liquor to cool before applying it to the skin. Keep it in a wood or glass container. Give the skin one application of the liquor, making sure that all parts are covered. Leave it flat over night, swab it again and then roll it up, flesh side in. Large skins should have a third application the following day and then be hung up to dry. Do not allow the skin to dry hard at any time during the process. It should be noted just here that skins may be kept in the tanning liquor from two days to one year and the longer they stay in the liquor the better they will tan. After draining, the skin should be beamed, Fig. 7, until it is soft and pliable. This will take time and plenty of "elbow grease." Following this, several hours of it on the average skin, you coat the flesh side with pure neat's-foot oil and then you're in for the "tubbing," Fig. 9. In the commercial tanneries this is accomplished with special equipment unsuited to the needs of the individual tanner. However, the same result can be obtained by simply tramping the skin, or skins, in a large wooden tub filled about one-half full of hardwood sawdust. If the skins are small, work several of them at a time in the tub. During the tramping process stop now and then to shift the skins and turn them first one side up and then the other. Tramp them until all traces of stiffness has been worked out. Finally, shake out the sawdust and lay the hair with a fine comb.



First work the skin over a fleshing beam to soften it; then apply the tanning solution to the flesh side



Finally coat the skins with pure neat's foot oil and place in a wooden tub one-half full of hardwood sawdust.

POPULAR MECHANICS

Dec. 1933

Lacquer-Coated Screens Make Storm
Doors and Windows

By applying two coats of transparent lacquer to your door and window screens, filling up the screen with a solid coating that prevents air from coming through, efficient storm doors and storm windows can be provided. Obviously this method of closing the screen is much better in appearance than tacking on tar paper, which is sometimes done for the same purpose. Another advantage of using lacquer is that it does not shut out the light and thus provides a translucent, yet weatherproof protection against the cold wintry blasts. The lacquer should be heavier for this purpose than for ordinary use and can be thickened by leaving the can uncovered to allow some of the thinner to evaporate. Lay the screen on a flat surface over some oiled paper and apply a coat of the lacquer. Let this dry thoroughly, then turn the screen over, remove the paper and coat the other side. This makes a tough, flexible coating that is easily removed with lacquer thinner.

☛ Rubber doilies cut from inner tubes and placed under flower pots will keep them from staining window sills.

For today, substitute plastic lids from coffee cans, etc.

POPULAR MECHANICS

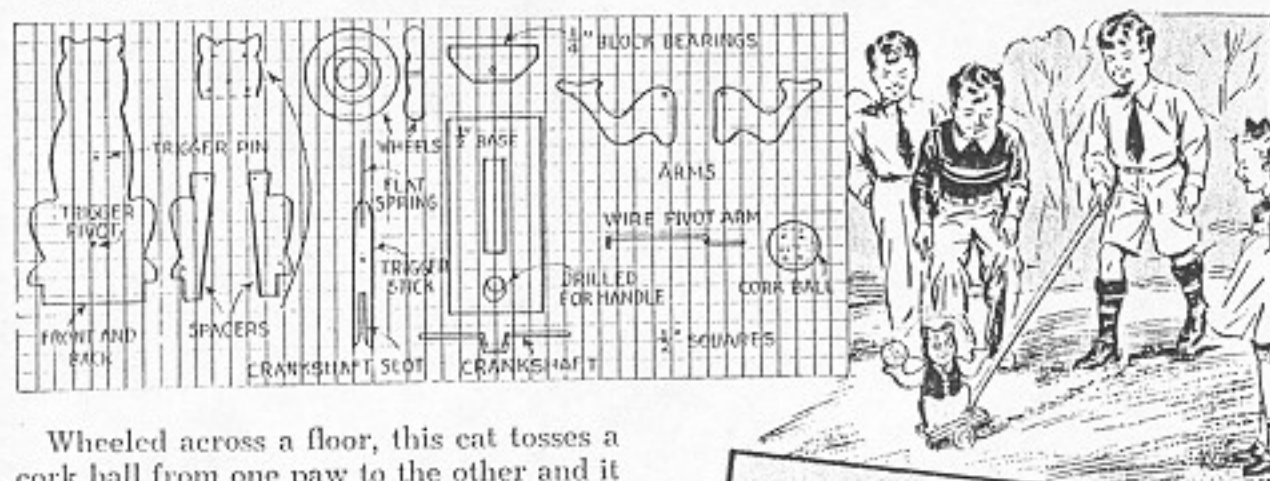
April 1939

Meat Cured in Barrel Smokehouse
Does Not Get Hot

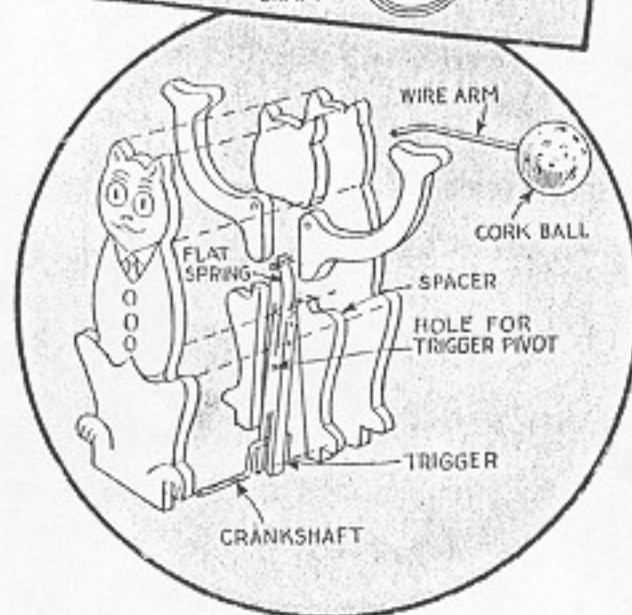
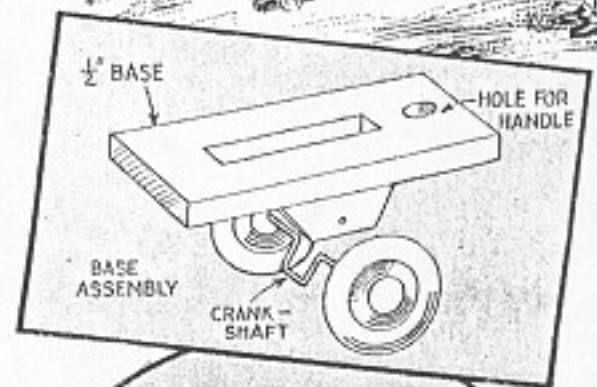
This smokehouse is claimed to be superior to the usual kind. A barrel was set in the ground and connected to a small fire pit by a line of sloping tile, after which a superstructure was built on the barrel. This had a shingle roof and crosspieces inside from which the meat was hung. Doors form one end to permit easy hanging and removal of the meat. During the smoking process the meat is kept cool and there is no dripping of fats, which is often the case when the fire is built directly under the meat. Control of the smoke is obtained by a piece of sheet iron laid over the hole.

POPULAR MECHANICS January, 1939

"Juggling Cat" Tosses Ball from Paw to Paw



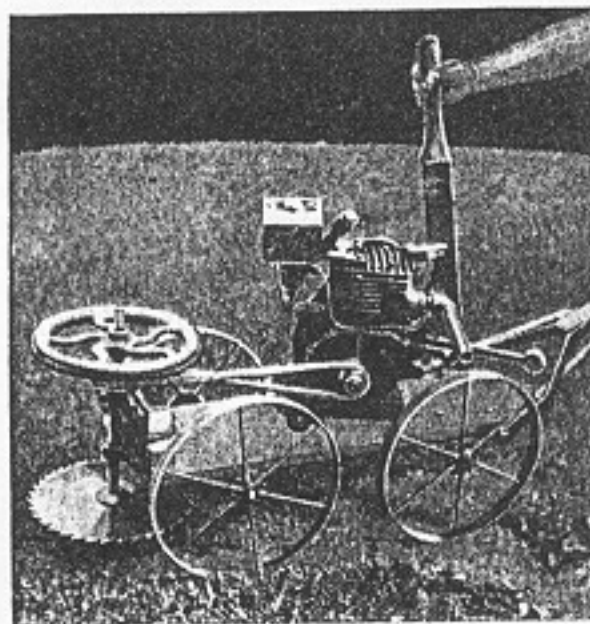
Wheeled across a floor, this cat tosses a cork ball from one paw to the other and it will entertain a small child for hours. Simple construction permits the parts to be cut in duplicate so that you could assemble a number of toys and sell them at a profit. Thin stock is used for the body, which consists of two duplicate parts with spacing blocks between, which are bradded together, leaving sufficient space for the pendulum to swing. This is provided with a piece of clock spring. The pendulum, pivoted on a brad driven through the toy, rides the crankshaft axle and is moved back and forth as the axle turns, snapping the spring strip across the trigger pin. The force of the spring striking the pivoted arms alternately flips them upward in an arc, tossing the cork ball back and forth over the head of the figure. The ball is impaled upon a wire which pivots at the central point of the figure. If desired, you can make the toy to suit the season. A rabbit can be substituted for the cat, and the ball can be replaced with an "egg," to convert the toy into an Easter special.



Popular Mechanics 1947

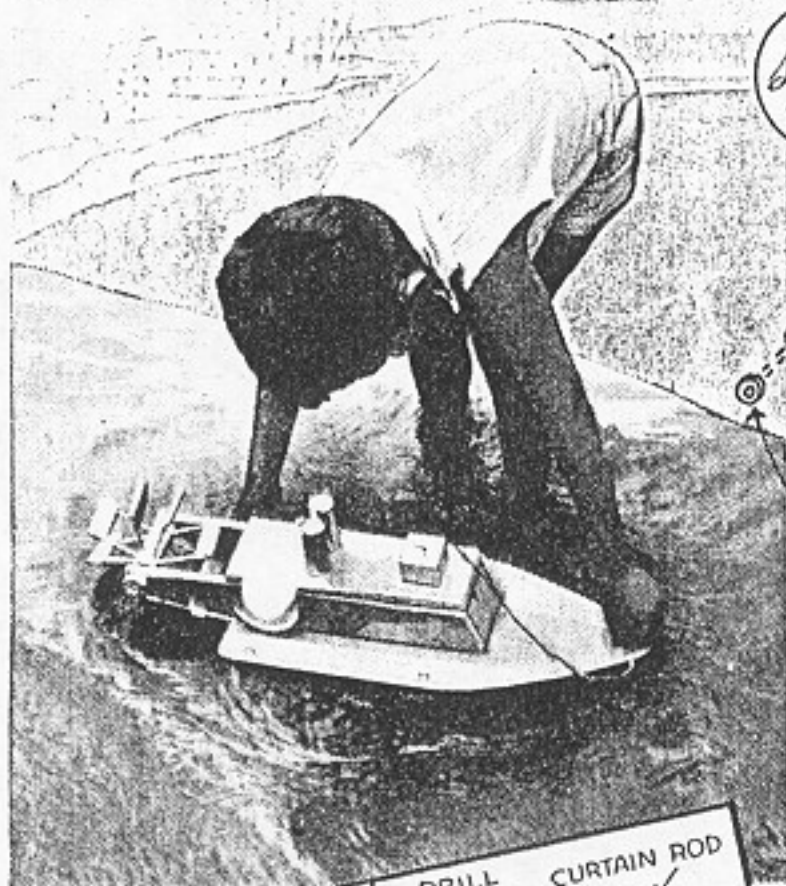
Mower Cuts Large Weeds and Heavy Brush With Ease

This unusual mower makes quick work of cutting large weeds and heavy brush, and it is just the thing for trimming around



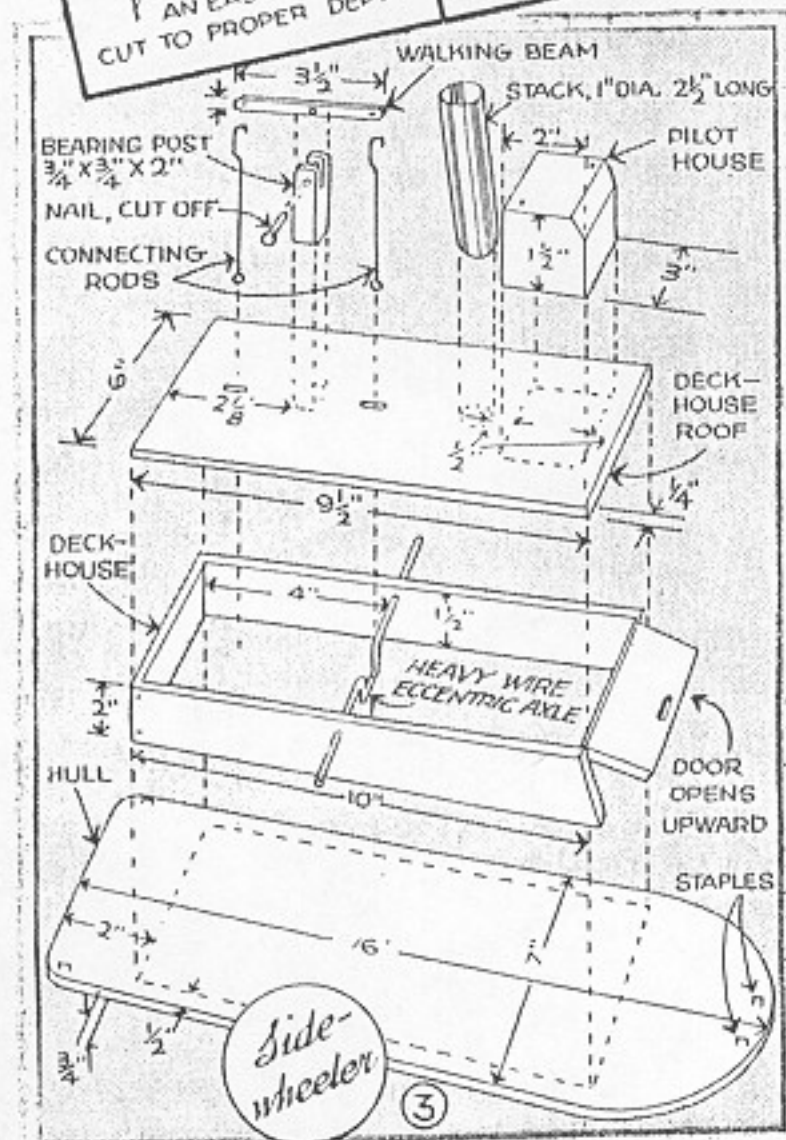
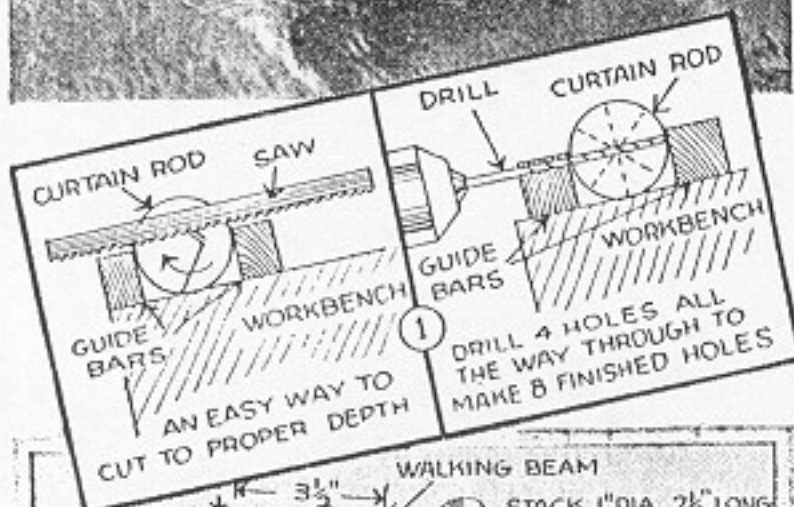
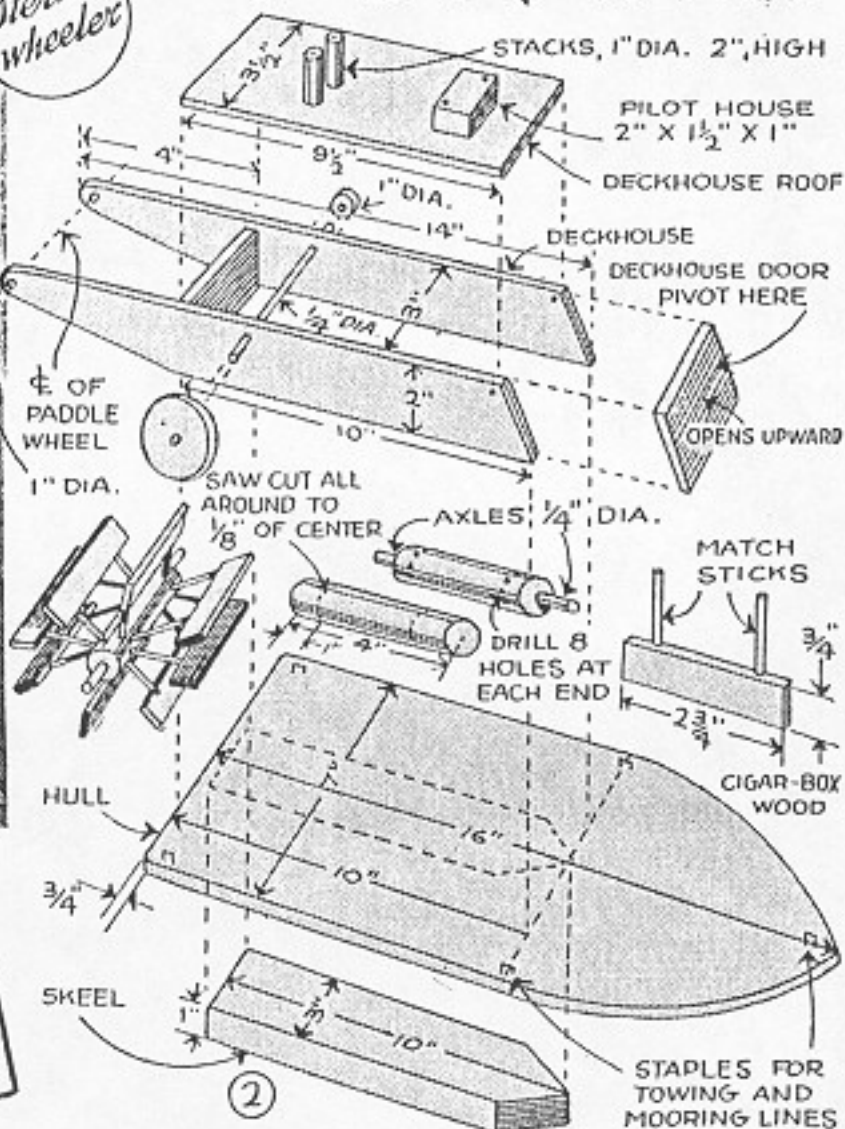
the bases of ornamental bushes, close up around trees and along fence rows. If pushed slowly it will even cut small trees up to 1½ in. in diameter. The mower consists of a 14-in. circular-saw blade mounted on a vertical mandrel, which rotates in a couple of pillow blocks. These are screwed to a crosspiece, which is bolted to a wide oak board that serves as the body of a cart mounted on four wheels. A 4-in. V-pulley and a large flywheel are put on the upper end of the mandrel, which is driven by a ½-hp. engine as indicated. A pulling handle is attached rigidly to one end of the cart and a lever is fastened to the starting pedal on the engine so that it can be started by merely giving the lever a quick pull. Mounting the saw so that it clears the ground by about 2 in. will be suitable for most work. If uneven ground surfaces make it necessary to have the saw higher at times, merely raise it by pushing down on the handle, which will raise the front end of the truck off the ground.

Ethan Viall, Knox, Ind.



Stern-wheeler

FUN with

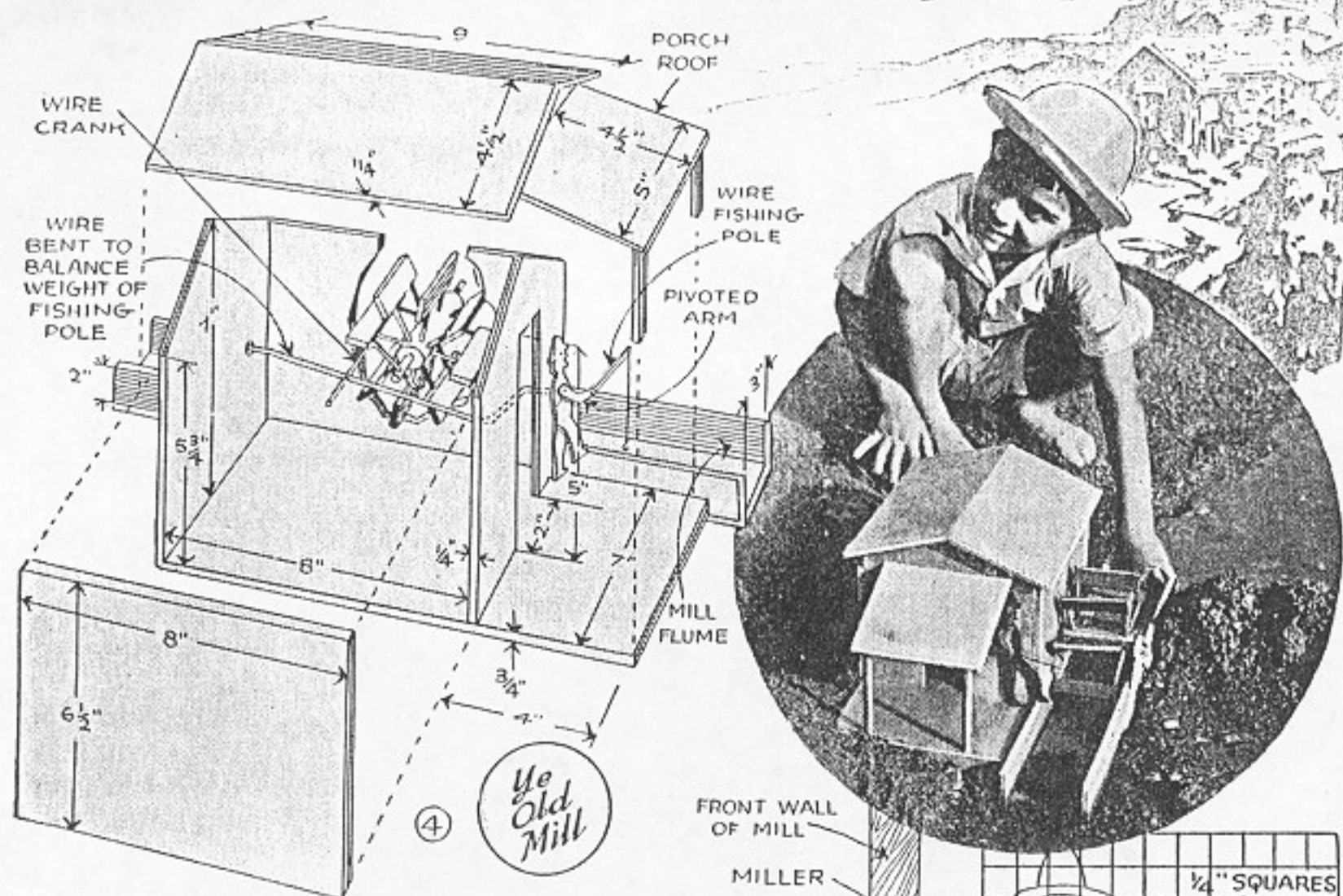


Side-wheeler

YOUR children will enjoy these toys, or they make interesting action ornaments where running water flows into a garden pool. A simple paddle wheel made from a discarded window-curtain roller, some kitchen matches, and strips cut from cigar-box wood, is the basis of each.

Fig. 1 shows simple jigs for drilling holes in the curtain roller to take match-stick spokes and for sawing the rods to form the axles, which are rounded with a knife after a saw cut has been made to the proper depth. When assembling the stern-wheeler as shown in Fig. 2, cut $\frac{3}{8}$ -in. disks from the ends of the curtain roller for the small pulleys on the paddle wheel and shaft. Use a coping saw to cut the large pulley on the other end of the shaft from some cigar-box wood. Whittle grooves in the edges of two of the pulleys to keep the belt from running off. Lengths of the curtain roller also make excellent smoke-stacks. Finish the stern-wheeler with a coat of aluminum paint. Use some heavy string for a belt, then watch the rotating motion of the paddle wheel and pulleys as

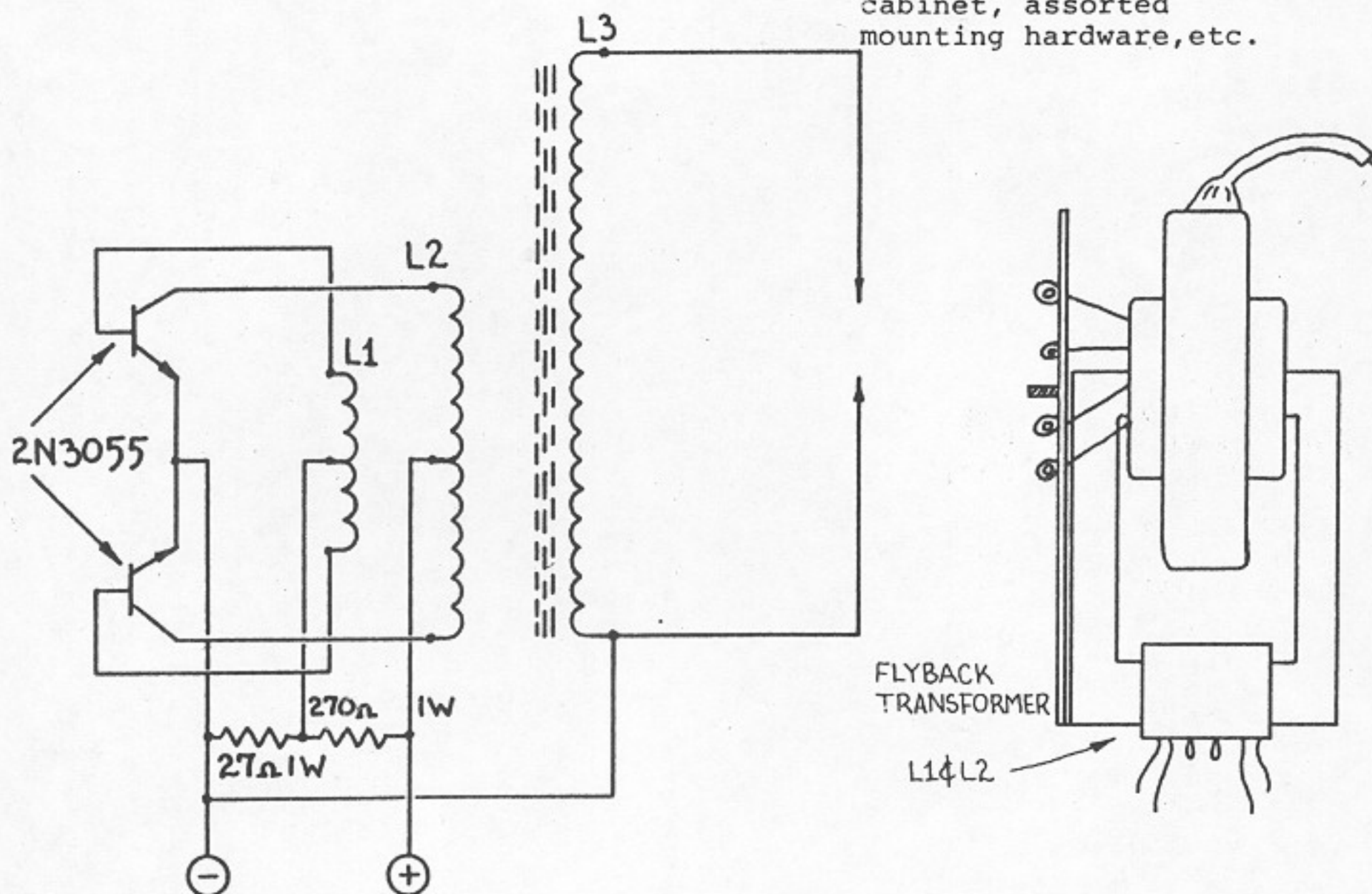
PADDLE-WHEEL TOYS



DATE APP'D FOR RFS 23 DEC 73		
REVISIONS		
NO.	DESCRIPTION	APP'D
	TESLA COIL (XR)	

PARTS LIST

- 2 2N3055 Germanium, NPN Power transistors.
- 1 27 ohm 2W Resistor
- 1 270 ohm $\frac{1}{2}$ W Resistor
- 1 Television "Flyback" transformer. (Any good new or used one will do)
- 2 Heatsinks. One for each of the 2N3055s.
- + #20 solid hook-up wire, cabinet, assorted mounting hardware, etc.



Special care is advised in the construction and use of this project. More than 20,000 volts is produced by the coil and with sufficient amperage to give a nasty shock or burn.

Obtain a television "flyback transformer". It may be a new one or a good, used one. Just about any flyback will work well in this circuit.

Remove the one or two turn filament winding at the bottom of the transformer core where L1 and L2 are to be wound.

Using #20 solid hook up wire to wind the two coils, wind 10 turns, closely spaced, on the flyback core for L2. Be sure

to leave the center tap exposed for later connection. Hold L2 in place with electrical tape or glue and wind L1 on top of L2. Wind L1 in the same direction as L2 and, again, leave the center tap exposed. Use additional tape to hold both coils in place. Mount the transformer on the chassis and the two transistors on their heatsinks, or use the metal chassis as a heatsink. Be sure to use insulating, mica washers and silicone grease for good thermal connection and electrical isolation. The transistors must not make any electrical connection to the chassis or to each other. Complete the wiring. Remove the cap that is usually attached to the topmost, heavy lead on the flyback. This lead is the "hot", high voltage lead. Solder a few extra inches of hook up wire to this lead and bend it to within $\frac{1}{4}$ inch of one of the solder lugs on the side of the flyback. Connect a power source to the tesla coil. The power source must be capable of supplying about 12 volts at 3 amps. A battery charger will do, or you can build a supply. Turn on the power and watch for a blue spark to jump from the high voltage lead to the lug. If you see a spark, all is well. Turn off the supply. You must not allow the high voltage lead from getting too close to another point that will allow a spark less than $\frac{1}{4}$ inch long. Any closer for more than a short period of time may over heat the transistors.

Using care, determine which lug on the flyback will produce the longest spark to the high voltage lead. This lug should be attached to the minus side of the 12 volt supply, the same as the emitters of the two transistors. You may use more than 12V. Up to about 25V is safe, but be careful not to over heat the transistors. Some warmth is OK, but if they're too hot to touch, turn the equipment off for awhile. Do not touch the high voltage lead while power is on. The high voltage will zap you right through the insulation on the wire.

If the circuit does not oscillate at first and produce the expected high voltage spark, check your wiring. If the wiring is OK, reverse the the connections to L2. It should work, now.

The frequency of oscillation is between 100KHz and 300KHz, depending upon wiring methods and parts used.

SCIENTIFIC AMERICAN, October 12, 1861

See also SURVIVOR Vol. 1, page 404, Burning Glass, Burning Mirror, Poly-zonal Lens.

See also SURVIVOR Vol. 3, Solar Energy, page 941, Solar Heating, page 947, Solar Power of the Past, page 944

—•••— Magic Mirrors and Burning Lenses.

The famous mirror which Ptolemy Evergetes caused to be placed in the Pharos at Alexandria belongs to the first class. This mirror is stated by ancient authors to have represented accurately everything which was transacted throughout all Egypt, both on water and on land. Some writers affirm that upon its sur-

face an enemy's fleet could be seen at the distance of 600,000 paces; others say more than 100 leagues! Albulveda, in his description of Egypt, states this mirror to have been of "Chinese iron," which Buffon considers to mean polished steel; but a writer in the *Philosophical Magazine*, 1805, supposes the metal to have been *tutenag*, a Chinese metallic compound, capable of receiving the highest polish. The existence of Ptolemy's mirror has, however, been generally treated as a fiction; but Father Abbat, in his *Amusemens Philosophiques*, first published at Marseilles in 1763, considers that it may have been at the time the only mirror of its kind, and being a great wonder, its effects may have been greatly exaggerated, making allowance for which, nothing remains "but that at some distance, provided nothing was interposed between the objects and the mirror, those objects were seen more distinctly than with the naked eye, and

that with the mirror many objects were seen which, because of their distance, were imperceptible without it."

It is certain that, under some circumstances, objects may be seen at a much greater distance than is generally supposed. Thus, it is stated that the Isle of Man is clearly visible from the summit of Ben Lomond, in Scotland, or 120 miles distant. Brydone states that from the summit of Etna mountains 200 miles off may be distinguished; and during his visit to Teneriffe in 1856, Mr. Piazzzi Smyth saw objects at a much greater distance.

Burning mirrors have been celebrated on account of their size and extraordinary effects. One of these optical machines was the work of Stettala, a canon of Milan; it was parabolic, and, acting as a burning glass, inflamed wood at the distance of 15 or 16 paces. Leonard Digges, in his "Pantometria," 1571, states that "with a glasse framed by a revolution of a section parabolically, I have set fire to powder half a mile and more distant." In the prosecution of this subject, the celebrated Napier and Sir Isaac Newton experimented with parabolic reflectors before 1673. Vilette, an artist and optician of Lyons, constructed three mirrors about the year 1670; one of these, which was purchased by the king of France, was 30 inches in diameter and of about 3 feet focus. The rays of the sun were collected by it into the space of about 1 inch. It immediately set fire to the greenest wood; it fused silver and copper in a few seconds, and in one minute vitrified brick and flint earth. A mirror, superior even to these, was constructed by Baron von Tschirnhausen about 1687; it consisted of a metal plate twice as thick as the blade of a common knife; it was 5 feet 3 inches in breadth, and its focal distance was 3 feet 6 inches. It produced the follow-

ing effects: Wood exposed to its focus immediately took fire, copper and silver passed into fusion in a few minutes, and slate was transformed into a kind of black glass, which, when laid hold of with a pair of pincers, could be drawn out into filaments. Pumice-stone and fragments of crucibles, which had withstood the most violent furnaces, were also vitrified.

The burning lens constructed by Mr. Parker many years ago, at an expense of upwards of £7,000, was of flint glass, 3 feet in diameter, and weighed 212 lbs.; the focal length being 6 feet 8 inches, and the diameter of the focus 1 inch. To concentrate the rays still further, a second lens was used and reduced the diameter of the focus to half an inch. Under this lens every kind of wood took fire in an instant, whether hard or green, or even soaked in water. Thin iron plates grew hot in an instant and then melted. Tiles, slates and all kinds of earth were instantly vitrified. Sulphur, pitch and all resinous bodies melted under water. Fir wood exposed to the focus under water did not seem changed, but when broken, the inside was burned to a coal. Any metal whatever inclosed in charcoal melted in a moment, the fire sparkling like that of a forge. When copper was melted and thrown down quickly in cold water, it produced so violent a shock as to break the strongest earthen vessels, and the copper was entirely dissipated. Though the heat of the focus was so intense as to melt gold in a few seconds, yet there was so little heat at a short distance from the focus that the finger might be placed an inch from it without injury. Mr. Parker having put his finger at the focus to try the sensation, found that it did not resemble that produced by fire or a lighted candle, but like that of a sharp cut with a lancet.

CULTURE OF PENICILLIN

Use aseptic technique throughout this procedure.

- A. Prepare a penicillium culture by exposing a slice of bread or citrus peel to the air at 70°F until a bluish-green mold develops.

Cut two slices of whole wheat bread into 1/2 inch cubes and place in a 750ml Erlenmeyer flask with a cotton (non-absorbent) plug. It is important that the bread used does not contain any mold inhibitors such as "mycoban". Sterilize the flask and contents in a pressure cooker for at least 15 minutes at 15 pounds. An alternate method is to place in an oven at 315°F for one hour.

Using a sterile transfer loop (flamed) transfer the spores from the bread or peel into the flask containing the bread cubes.

Allow the cubes to incubate in the dark, at 70°F for 5 days. After incubation, store in the refrigerator for not longer than two weeks.

- B. Prepare one liter of the following media:

Lactose monohydrate	44.0 gm.
Corn Starch	25.0 gm.
Sodium Nitrate	3.0 gm.
Magnesium Sulfate	0.25 gm.
Potassium Phosphate Mono	0.50 gm.
Glucose monohydrate	2.75 gm.
Zinc Sulfate	.044 gm.
Manganese Sulfate	.044 gm.

Dissolve in order in 500ml of cold tap water and add sufficient cold tap water to make one liter.

Adjust pH to 5.0-5.5 using HCL. Fill a series of milk bottles with a quantity of this media. Use only enough media so that when the bottle is placed on its side the media will not touch the cotton plug.

Sterilize bottles and media in a pressure cooker or stove as previously outlined. When cool inoculate with spores from bread cubes. Use approximately the equivalent of one tablespoon.

Allow bottles to incubate on their sides at 70°F for 7 days. It is important that the bottles do not be disturbed during this time. At the end of 7 days if your culture is capable of producing penicillin it will be dispersed in the liquid portion of the media.

Filter fermentation media, plug with cotton and refrigerate immediately. Use as soon as possible.

- C. To extract the penicillin the following procedure may be attempted. Do the following technique as rapidly as possible.

Adjust cold fermentation filtrate to pH 2.2 using .01 N HCL. Mix cold filtrate with cold ethyl acetate in a separatory funnel and shake well for 30 seconds.

Drain ethyl acetate into a beaker which has been placed in an ice bath and repeat process until all filtrate is depleted.

Add 1% potassium acetate and mix. Permit ethyl acetate (flammable) to evaporate. This can be induced by a constant flow of air over the top of a beaker.

The remaining crystals are a mixture of potassium penicillin and potassium acetate.

REPEAT. DO EXTRACTION AS RAPIDLY AS POSSIBLE.

Lots of Fun with Microscope Made from Spool



By using a well-known optical principle, with but slight effort you can make an instrument capable of magnifying certain objects considerably. Take an ordinary thread spool, enlarge the bore in one end

and paint the inside surface black. Glue a piece of black cardboard over the top and pierce with a small needle. On the bottom tack a disk of Cellophane. Place a drop of water on this and lay a fly's wing or other thin, transparent object in place. Hold before a strong light and look through the pinhole.—H. Arrall, Newburyport, Mass.

Space Needed for Plants and Trees Specified in Chart

If you have a certain number of plants and wish to know how much space they will occupy, this chart tells at a glance. If you want to know the exact number of

DISTANCE		NUMBER
1 FT. X	1 FT	43560
1 1/2 " X	1 1/2 "	19360
2 " X	2 "	10890
2 1/2 " X	2 1/2 "	6970
3 " X	3 "	14520
3 1/2 " X	3 1/2 "	7260
4 " X	4 "	4840
4 1/2 " X	4 1/2 "	2722
5 " X	5 "	1742
5 1/2 " X	5 1/2 "	1210
6 " X	6 "	537
6 1/2 " X	6 1/2 "	302
7 " X	7 "	194
7 1/2 " X	7 1/2 "	134
8 " X	8 "	103
8 1/2 " X	8 1/2 "	70
9 " X	9 "	40
9 1/2 " X	9 1/2 "	27

plants an acre will accommodate, read the table backwards. Figured on the basis of one acre, 43,560 sq. ft. of ground, the number and spacing of everything from tomato vines to fruit trees can be determined.

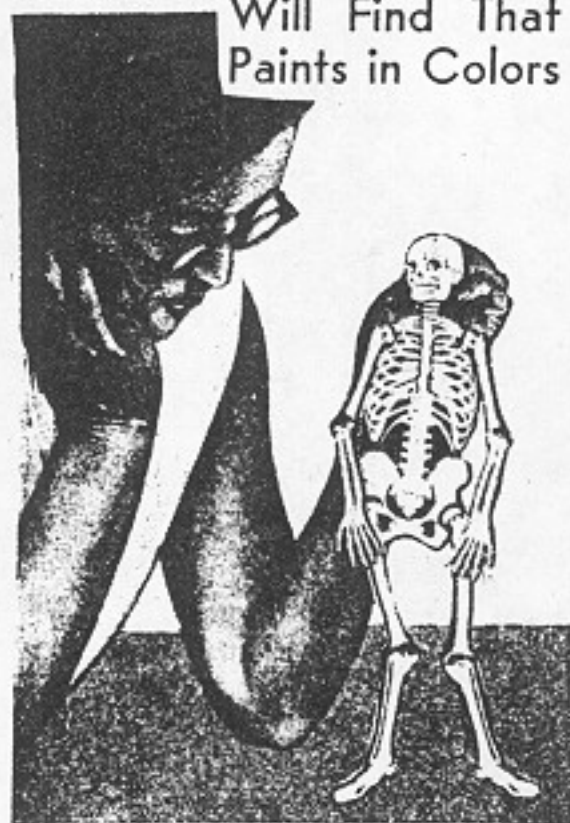
LUMINOUS PAINT

and Its Preparation

SCIENCE AND INVENTION Nov. 1930

By George D. Donaldson

Those Who Like to Experiment with Chemicals Will Find That the Preparation of Luminous Paints in Colors Is Interesting, Educational, and Fascinating



A jointed pasteboard skeleton painted with luminous paints can be made to cut fantastic figures in a darkened room.

TOPs that shine in the dark when they spin, luminous valentine and greeting cards, cigarette lighters that shine at dusk and weird dancing skeletons can all be made by one who likes to experiment with chemical mixtures.

The basis of luminous paint is a sulphide of zinc, calcium, strontium or barium, with certain excitors such as compounds of bismuth, uranium, manganese, thallium, etc. The simplest phosphorescent substance is made by heating calcium oxide (pure lime) with one-third its weight of sulphur and then adding a drop of a five percent solution of bismuth nitrate solution to every fifteen grams of the mix. The whole is then mixed, dried and heated to redness in a crucible over a Bunsen burner for half an hour. One may use barium carbonate with sulphur, also strontium carbonate with sulphur, and adding a drop of five percent bismuth nitrate solution, or manganese sulphate solution, with or without the same amount of thorium



A luminous butterfly, cigar lighter and valentine.

nitrate solution. The resulting products will have different colored phosphorescences, when exposed to a strong light and then viewed in the dark.

If the experimenter makes many mixes and calcinations, then new clean crucibles should be used on each "batch." Clay bubble pipes make good crucibles, and their cost is a tenth that of the chemical porcelain crucibles.

Working with clean crucibles, contaminations from previous preparations are avoided.

Another method for making a luminous product is to pass hydrogen sulphide gas into zinc sulphate or zinc chloride solution, and also adding a solution of cadmium chloride during the passage of the gas. The precipitate of zinc sulphide and cadmium sulphide is filtered off, washed, and calcined in a crucible provided with a cover which will shut out practically all the air. Clay works well with a bubble pipe bowl.

Another mix is 40 grams barium oxide, 9 grams of sulphur, 0.7 grams of lithium phosphate and 3cc of a solution of 0.4 grams of copper nitrate dissolved in 100cc of denatured alcohol. The whole is calcined for three-quarters of an hour. It glows red.

One may buy a very good grade of luminous paint from various manufacturers. Collodion, gum arabic, and very thin spar varnish can be used singly as a vehicle for the phosphorescent substances which you may make.

A dancing, jointed, stiff paper skele-

ton is sold at many novelty and carnival-goods stores. Such a skeleton about 15" high painted with luminous paint will cause much amusement when operated in an absolutely dark room. Strings tied to the limbs will enable one to make it dance in a very realistic manner.

A card coated with luminous paint can be caused to give a very pretty effect if a leaf, some lace, a paper cut-out or other figure is held over it and the coated side held to a strong light. When the card is viewed in a darkened room, an image of the object now removed, can be clearly seen. Photo negatives produce weird results, and it is possible with a good grade of paint coated very evenly upon the card to recognize the characters of the negative glowing in the dark!

The familiar disc top carried on a



A disc of cardboard painted as indicated produces a top that shines in the dark while it spins.

looped string and spun with the hands can be made to give a fire-effect in the dark if it is painted or streaked with a luminous paint. Wind-up tops of the "push the peg" variety can also have the phosphorescent paint applied to them to give a luminous effect in the dark.

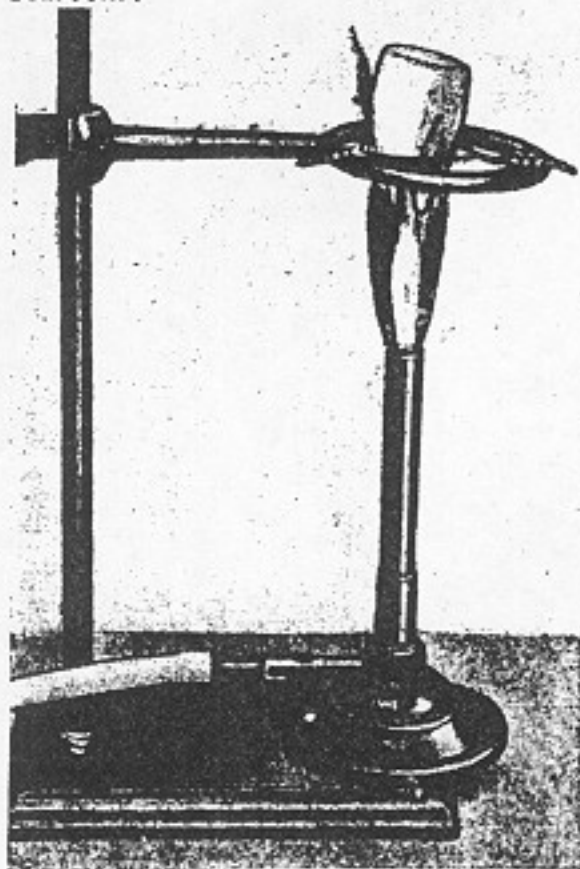
Quite a novelty can be made by painting the salutation on valentine, greet-



Hold a leaf against a sheet of paper prepared with luminous paint, then expose to the light; in the dark the outline of the leaf will appear as a luminous area.

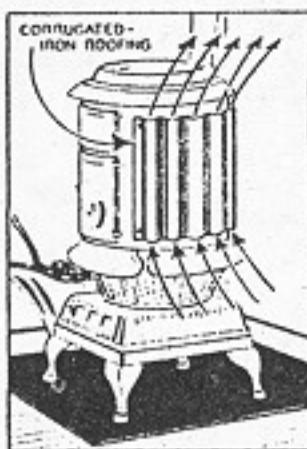
ing, birthday and other cards in luminous paint, adding in small script, "Look at me in the dark." Paper cut-outs such as skulls, butterflies, table lamps, and other items all show up

nicely when prepared with luminous paint. The constellations can be done in tiny paper stars made luminous with the paint. Quite a novelty would be a luminous dipper on the ceiling of the bedroom!



The bowl of an old clay pipe makes an excellent crucible and a different bowl is used for each chemical mixture. Clay bubble pipes are cheap; they are destroyed or put aside after any color has been prepared, thus preventing contamination from previous mixtures.

Shop Stove Improved by Casing of Corrugated Sheet Iron



Owners of small shops and garages who heat their buildings with stoves can improve the efficiency of the latter by encasing them with corrugated sheet iron as indicated. Air will circulate rapidly between the surface of the metal and stove, and the casing will also tend to reduce fire hazard if the stove must be placed near a wall.

Chemicals Made from Whey Open New Field for Dairy

Whey, once a troublesome waste product of skim milk, is now being turned to profitable use in the making of lactic acid. In the past lactic acid has been made from molasses, cornstarch and other fermentable sugar sources, but the use of surplus milk for this purpose opens a new source of income for dairymen. Whey is a by-product of the manufacture of casein from skim milk. Lactic acid is used in the textile industry, in baking, in hardening

Door Knobs Serve as Pestle in Emergency



Amateur chemists who need a pestle for crushing crystals of various kinds, will find that a pair of discarded door knobs and a strong bowl serve the purpose. A little friction tape wrapped around the knob held in the hand will improve the grip.

pickles, soda-fountain beverages, medicines, lacquers, and in the leather industry to neutralize lime used to remove hair from hides.

Make Your Own Castings

By L. K. Wright Science and Invention November, 1930

A Very Large Number of Otherwise Keen "Make It Yourself" Enthusiasts, Who Literally Do Make Everything Themselves, Invariably Balk at the Prospect of Making Their Own Castings. Like Every Other Job, of Course, There Is a Knack in It, and a Few Tricks to Be Learned

A GREAT many "how-to-build-it" articles very easily skip over the casting problem by advising the constructor to "take the pattern to the foundry" so that the required number of pieces may be cast. To the builder familiar with casting practice this is superfluous advice; but to those not cognizant of pattern and founding procedure such a single sentence of instruction on this subject is the bugaboo which deters many from constructing the models they are anxious to build.

Patterns form the most expensive part of the production of castings. Once a pattern is made up almost any number of castings may be cast by the use of it. The cost of casting is so reasonable that it does not pay to attempt to pro-

vide the metal and apparatus to pour them in the worker's own shop, unless they are of the low melting point metals, such as the tin, lead, bismuth and zinc alloys. The low melting point alloys are suited to small experimental parts and after proving the piece by a test fit the pattern thus checked may then be used for an iron or brass casting.

Iron castings range from five to fifteen cents per pound, brass and bronze from thirty to sixty cents and aluminum from forty to seventy cents per pound. Small intricate castings cost a great deal more than large simple ones, but on the whole the prices are usually very reasonable.

To make small castings about one or two cubic feet of fine mould-

ing-sand will be required, which will be sufficient for most experimenters. This material may be purchased from a foundry supply house, the foundry itself or obtained by a dealer in hardware. If it is possible to obtain the yellow sand it will be found to serve better than the black material generally employed, but the latter will serve, as it does in thousands of foundries.

Should the amateur decide to find his own sand, preference should be given to the finest material, which clings together in a solid cake when a damp mass of it is compressed between the hands. Common river, lake or ocean sand is not suitable as it is too coarse and will not hold its form.

In order to prevent the sand from getting on the floor and being tracked about the place it is best to construct a moulding-table. While an ordinary bench or table will do it will be found that convenience of working at a moulding bench, of the type shown in Fig. 1, will more than offset the labor necessary to build it.

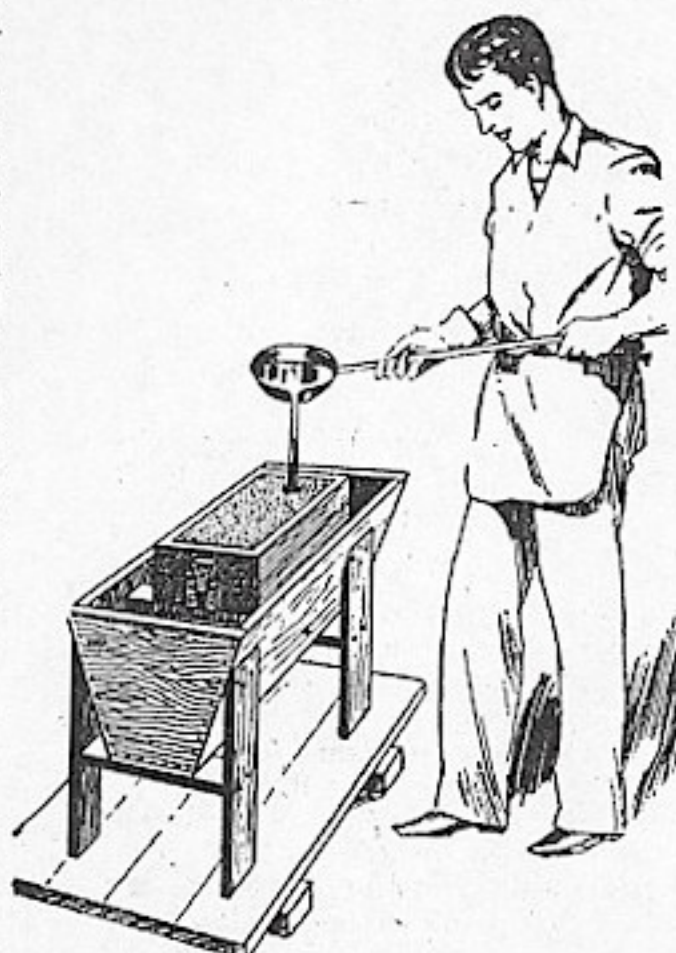
Since the bench is subject to considerable pounding it is best to construct it of one-inch material, fastened

with screws, so that the joints will not open. Two rails should be screwed to the front and back boards inside the trough so that the cross-boards, which in turn support the mould, may be easily shifted. By sliding the mould with the cross-boards the sand below is easily available. Fig. 1 depicts the general form of a suitable moulding bench, and conveys more concrete information than would a page of text.

A few simple tools will be required for handling and preparing the sand. A small shovel or scoop may be used for filling the moulding box or "flask." Whether sand is new or used over and over again it is best to make a sieve of ordinary wire screen. A piece of wire netting fastened to a box or hoop makes a good sieve.

A rammer, used for pushing and ramming the sand in place, may be easily made by whittling down a small rolling pin; one end being cut to a wedge shape while the opposite end is left full size for ramming. The center portion may be thinned to offer an easy grip for the hand. For small work an old teaspoon may be used for working the sand. The above "tools," together with a bag or knitted stocking filled with coal dust, completes the necessary equipment, with the exception of the "flask."

A simple "flask" consists of a rectangular box, cut longitudinally in half and provided with a loose top and bottom. A "flask" suitable for small castings may be made of one inch stock and is best constructed by first making a box about 12"X8"X8" high, and then sawing it in half, so as to provide two frames. The upper section is called the "cope" and the lower portion is



Pouring the molten metal into the mould

termed the "drag."

Each section is provided with corners and sand holders, screwed in place, the former members serving to strengthen the "flask" and the latter triangular strips to provide a hold or shelf for the sand so that when the two halves are separated the sand will not slide out of the "flask" sections.

Tapered dowels or cleats fastened to the sides of the "flask" sections must be carefully made so that the two halves

fit accurately together. Care should be exercised in building the "flask" to assure a rigid form, with sections that accurately match. The construction of such a "flask" is shown in Fig. 2. The cover, called the "moulding-board" is a duplicate of the flat section used as the "bottom board." These boards, of one inch stock, should measure about 13"X9", and both are best provided with 1"X2" cleats to strengthen them and make it easier to pick up the "flask" from the floor.

The moulding sand should first be screened to remove the lumps, then it should be carefully moistened; sifted and shovelled about so that the moisture is evenly distributed. If, when compressed between the fingers, the sand forms into a cake and shows all the finger marks it has sufficient moisture and is ready for use. If it fails to cake or if it crumbles it is too dry and more water is required. A sprinkling pot of small size will be found useful in bringing the sand to the proper working consistency, as it will spread the water and prevent uneven wetting.

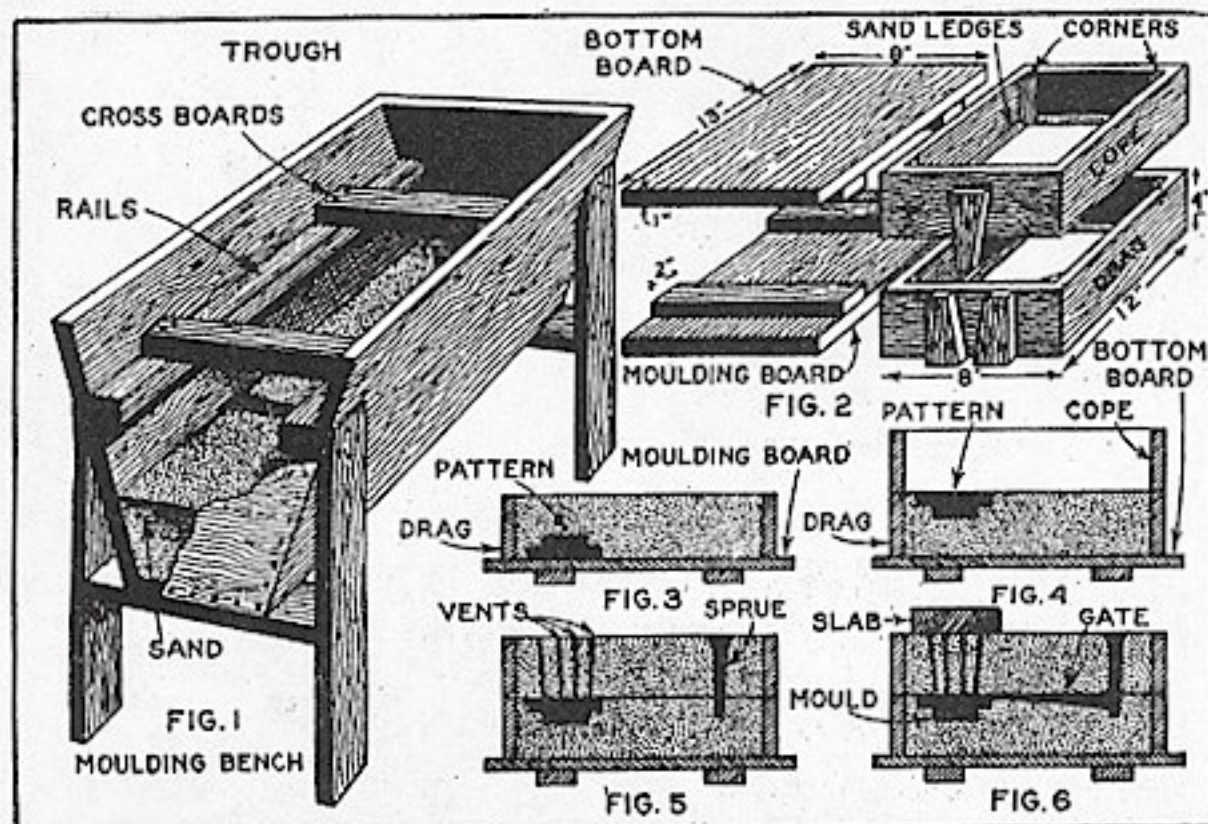
The sand must be of the proper consistency, for if it is too dry it will crumble or being too wet it will "boil" when pouring in the molten metal through the formation of steam. In either event poor castings will result.

To make a mould the operation is as follows: The "drag" or lower section of the "flask" is placed on the "moulding-board" and the pattern, assumed to be a simple affair, such as a face plate for a drill press, is placed flat side down on the "moulding-board," off to one side rather than squarely in the center.

A quantity of sand is then sifted into the "drag" until it is filled level, as shown in Fig. 3. Then the sand is "rammed" down and smoothed off even with the top edges of the "drag," by using the "bottom-board" as a straight edge. The sand must be rammed properly, for if rammed too hard the surface

of the sand next to the pattern will disclose cracks. If not rammed enough the sand will fall or run out of the "drag." Several trials should provide sufficient experience to determine how to pound in the sand.

When the pattern has been properly rammed in the "drag," put the "bottom-board" on top and then turn the "drag" other side up. The "moulding-board," now at the top, is removed and the upper half of the mould, the "cope," is placed in position, as depicted in Fig. 4. The surface of the sand held in the "drag" is dusted with coal dust by shaking the dust bag over the "flask." The dust which falls on the pattern is removed by blowing. The dust prevents the two sections of sand from adhering.



These sketches give all the detailed information required to make a moulding bench and "flask," or container for the sand mould.

The "cope" is then filled with sand and rammed, and after leveling off, a wire about the size of a knitting needle is pushed down through the sand until it touches the pattern. A number of holes should be provided by means of the wire so that the steam and air may escape when the mould is being poured. Fig. 5 discloses the manner of providing the vents.

A pouring hole is required and this may be cut by means of a "sprue-cutter" made from a piece of $\frac{3}{4}$ " iron pipe. If desired a tapered plug may be used to form the "sprue" or pouring hole. After forming the "sprue," place the "moulding-board" on top of the "cope" and then the "cope" is lifted from the "drag." This is the most critical stage of the operation, for if the "flask" is not properly made and sticks, or the sand not of correct texture, the mould may be destroyed by the sand falling out. With a little patience and practice the "flask" may be parted without difficulty and a clear mould obtained.

Cutting the "Gate"

With the two halves of the "flask" separated the next operation is to cut a "gate" in the sand, so that the molten metal may flow from the "sprue" to the form left by the pattern, after it is removed. An old spoon may be used for cutting the channel. When this is accomplished the next step is to remove the pattern from the sand. A sharp rod or "draw pin" is driven into the pattern, which is then tapped in all directions to loosen the sand slightly. It is a good plan to withdraw the pattern slowly, rapping it gently while doing it, so that any sand which has a tendency to adhere will loosen.

The "cope" is then placed back in position upon the "drag," the accurate centering of course depending upon the dowels or cleats. A heavy slab or brick is placed on top of the "flask" above the mould to prevent the pressure of molten metal from separating the sections or lifting the sand. The mould is then ready to pour. Fig. 6 shows the "flask" prepared for the molten metal.

The molten metal should be clean and sufficiently heated to pour well. It should be poured into the mould in a small steady stream, so that steam and air have chance to escape. The metal should not be poured directly into the center of the "sprue" for the metal will otherwise strike the bottom with enough force to loosen the sand, which would result in a dirty casting.

Sand that is too wet will emit a large volume of steam and will produce imperfect, porous castings.

Most castings are subject to a certain amount of shrinkage and where ac-

curacy is required the pattern is made to provide for this reduction by making it of the proper oversize.

Shrinkage of Castings

Copper	.....	$\frac{3}{16}$	inch	per	foot
Aluminum	.....	$\frac{1}{4}$	"	"	"
Brass	.....	$\frac{3}{16}$	"	"	"
Cast Iron	.....	$\frac{1}{8}$	"	"	"
Tin	.....	$\frac{1}{16}$	"	"	"
Zinc	.....	$\frac{5}{16}$	"	"	"
Lead	.....	$\frac{5}{16}$	"	"	"

To obtain the weight of a casting, where white pine is used for a pattern, the following will be the approximate weights, where the pattern weighs one pound:

Aluminum	.....	4.8
Iron	.....	16.0
Lead	.....	25.0
Copper	.....	19.0
Brass	.....	18.5

Where a non-shrinkage alloy is desired, which in turn may be used as patterns, the following formula should be employed:

Tin	.....	58.5%
Zinc	.....	22.0
Lead	.....	12.5
Antimony	.....	7.0

Other formulas are:

Magnalium:

Aluminum	.....	85 to 95%
Magnesium	.....	15 to 5%

Y Alloy:

Aluminum	.....	93.5%
Copper	.....	4.
Nickel	.....	2.
Magnesium	.....	1.

Reclaiming Zinc from Dry Cells

VERY often the experimenter has a use for zinc and that of a dry cell would be satisfactory if it were not for the difficulty in cleaning out the container.

A method that is wholly satisfactory is to connect the plus and minus terminals of the cell to two wires coming from a transformer having an output of about 10 amperes at 10 volts. In a minute the cell will become warm and the gases formed will cause the insides of the cell to be forced out, leaving the zinc container relatively clean.

When using this method, the cell should be in a horizontal position as the contents are usually expelled with considerable force.—*Laurence E. Lechleitner.*

Iodine Remover

TO a little tincture of iodine in a test-tube, add a solution of sodium thio-sulphate (hypo) and it will turn white. The solution can be used for removing iodine stains from clothing or hands.—*Benjamin Heller.*

Britannia Metal:

Tin	.....	85.5%
Antimony	.....	10.
Copper	.....	5.

Pewter:

Tin	.....	90.5%
Antimony	.....	7.
Copper	.....	3.

Low Melting Point Alloys

For the model maker it is best to cast the part in one of the low melting point alloys; then trim and fit the casting to the desired shape. If alterations are required the pattern can be worked over until the builder is certain that castings obtained from the foundry in brass or iron will be exactly suited to his requirements.

The experimental castings, either rejected as not being of the proper design or as being porous, may be melted down and the metal used over again.

Metals and alloys of the low melting point variety may be melted in an iron vessel, such as a clean iron or steel pot. The writer has used an enamelled sauce pan heated over an ordinary charcoal fire but either a gasoline torch or a Bunsen burner may be used.

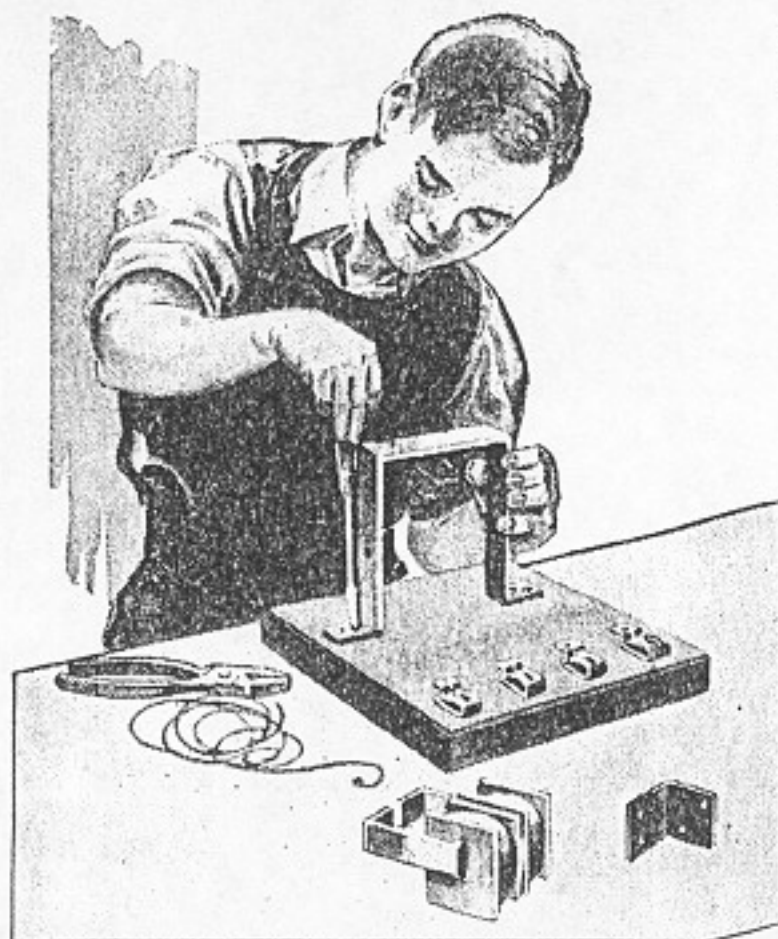
Much ingenuity is sometimes required in making the patterns, so that they will leave the moulds without disturbing the sand.

Popular Science, 1904

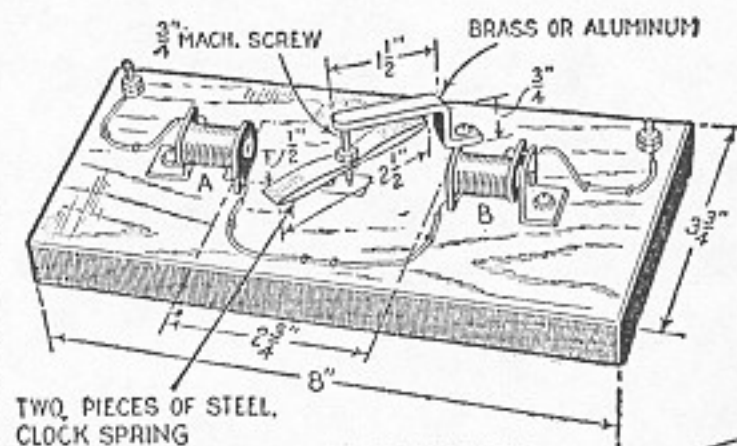
SUN'S HEAT AS A SOURCE OF POWER.

Harnessing the sun's rays for the generation of steam is a new and remarkable achievement in California. By utilizing the heat energy which comes from the sun steam of sufficient forces was produced to pump 1,400 gallons of water per minute against a head of 12 feet. This was accomplished by means of a solar motor erected at the ostrich farm at South Pasadena, Cal. A reflector was built in the shape of a huge open glass umbrella, 32 feet in diameter. The parabolic reflecting surface, 640 square feet, says the Metal Worker, is always automatically turned toward the sun by means of clock work, so that the rays are focussed in rings on the central tube or boiler, which takes the place of the stick in the umbrella. The boiler is a tubular one, holding about 100 gallons of water. At a test 192 gallons of water per hour was evaporated, forming steam of 150-pound pressure. The motor is rated at about 15 horse-power and cost \$2,500. The apparatus is used for pumping water for irrigation purposes.

5 TOY

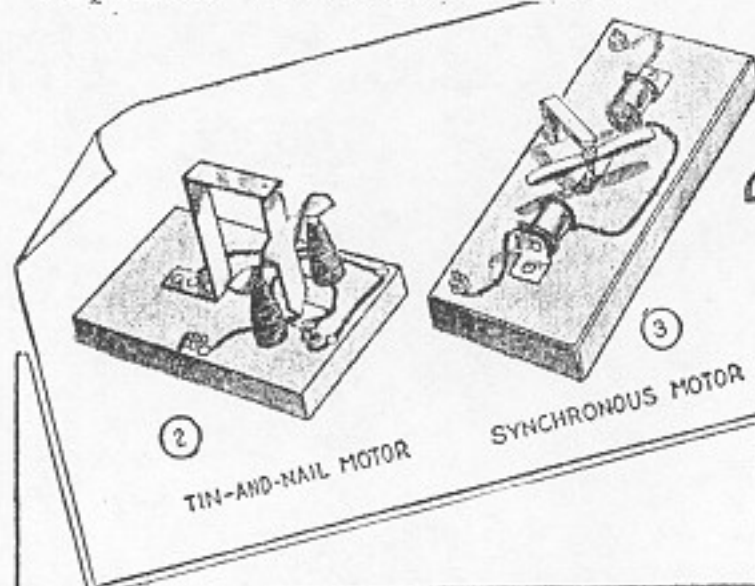


Popular Mechanics 1939



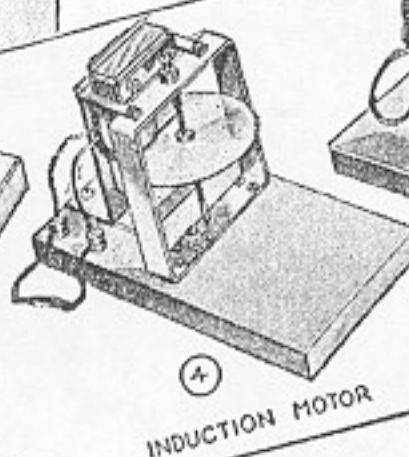
TWO PIECES OF STEEL, CLOCK SPRING
① MAGNETS A & B FROM BUZZER CONNECTED IN SERIES
SYNCHRONOUS MOTOR

SERIES MOTOR

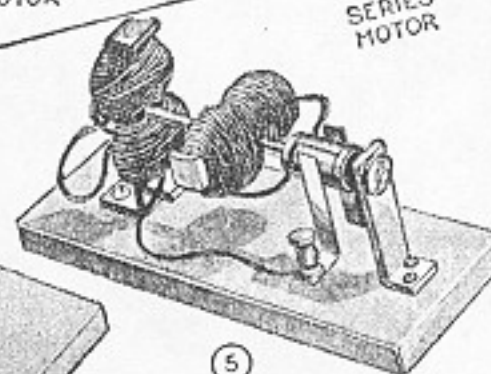


② TIN-AND-NAIL MOTOR

③ SYNCHRONOUS MOTOR



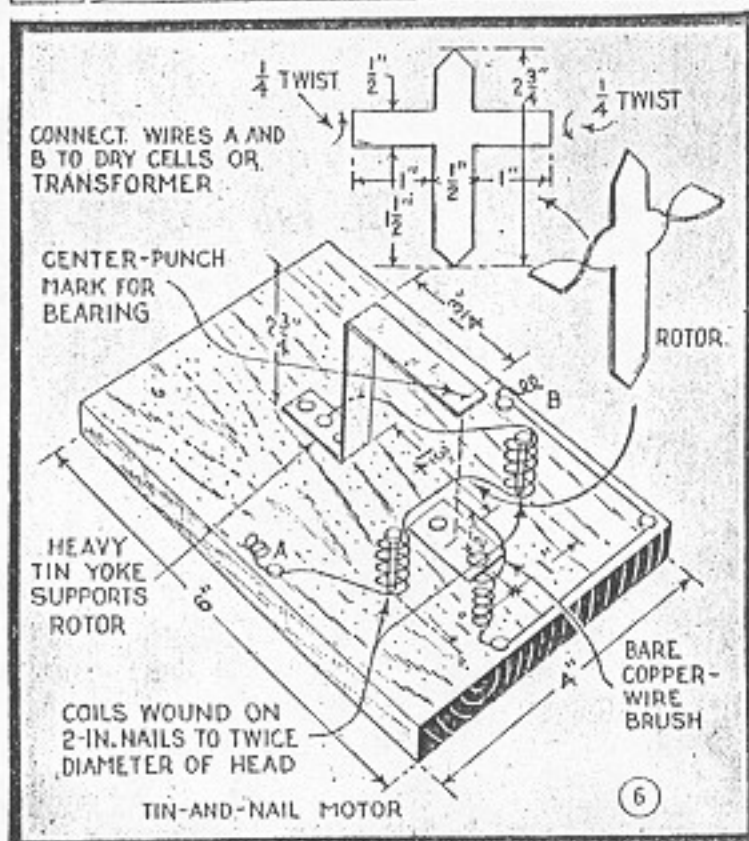
④ INDUCTION MOTOR



⑤

By C. A. CROWLEY

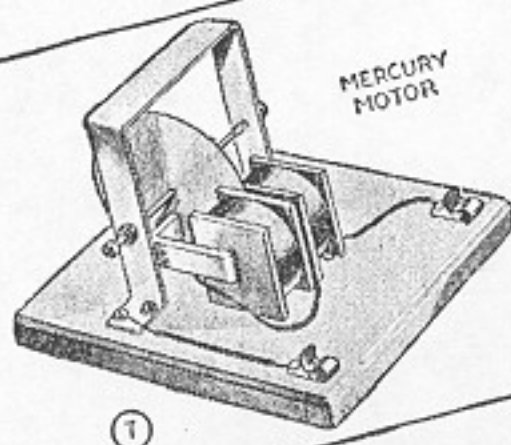
TIN-AND-NAIL MOTOR: One of the simplest forms of an electric motor where small electromagnets cause a tin rotor to spin, is shown in Figs. 2 and 6. This motor runs on a couple of dry cells or will operate on 6 volts a.c. provided by a transformer. The rotor acts like a tiny switch as it wipes against a brush lightly, turning on current momentarily just before its arms pass over the electromagnets. This current impulse, which occurs at each half rotation, is just enough to keep the rotor going. The rotor is cut from tin to the cross shape shown and the side arms are twisted at right angles. The electromagnets or field coils are wound in series on two nails, both windings being in the same direction. The nails are 2 in. apart. One end of the wire is scraped bare and twisted to form a tight coil which serves as a binding post, it being tacked down to



MOTORS

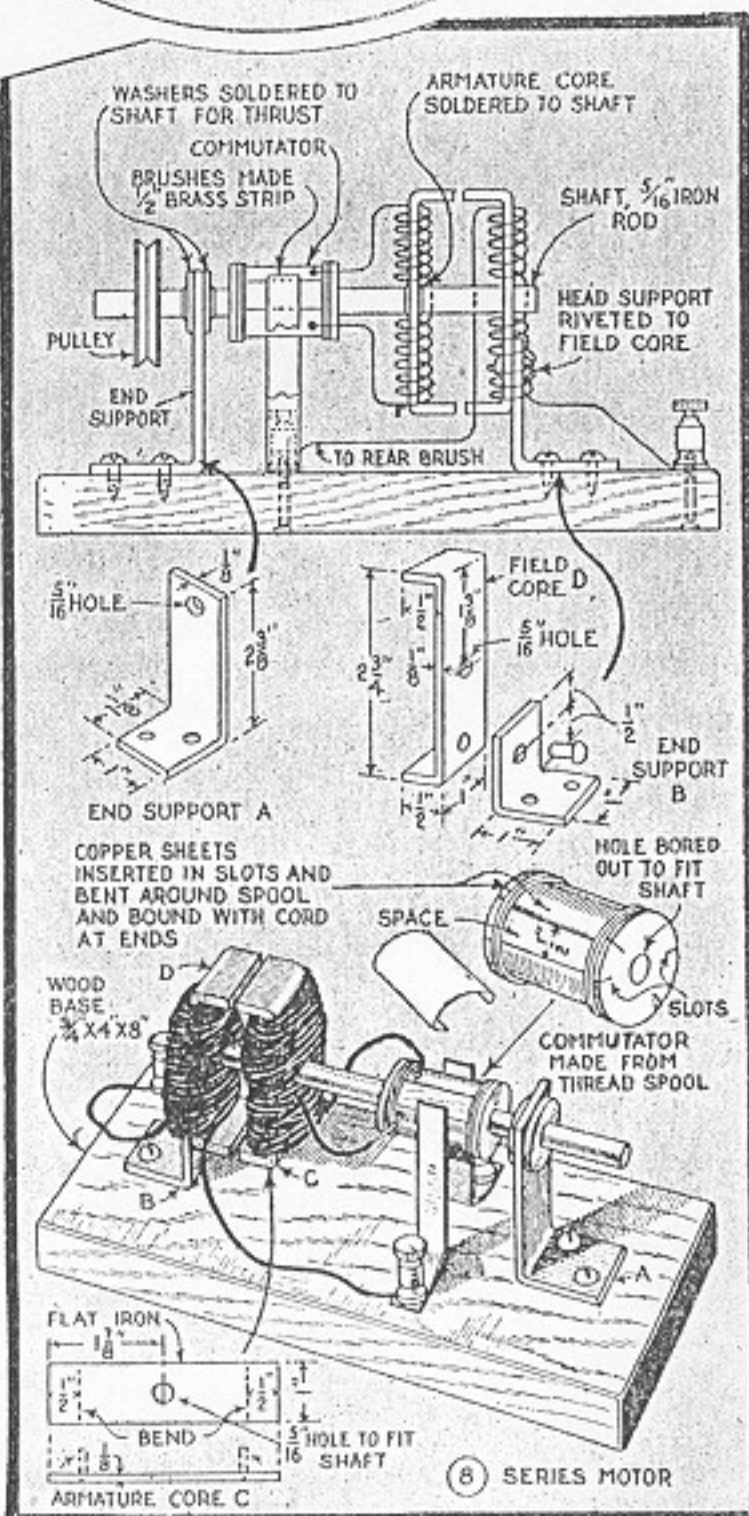
convey basic ideas

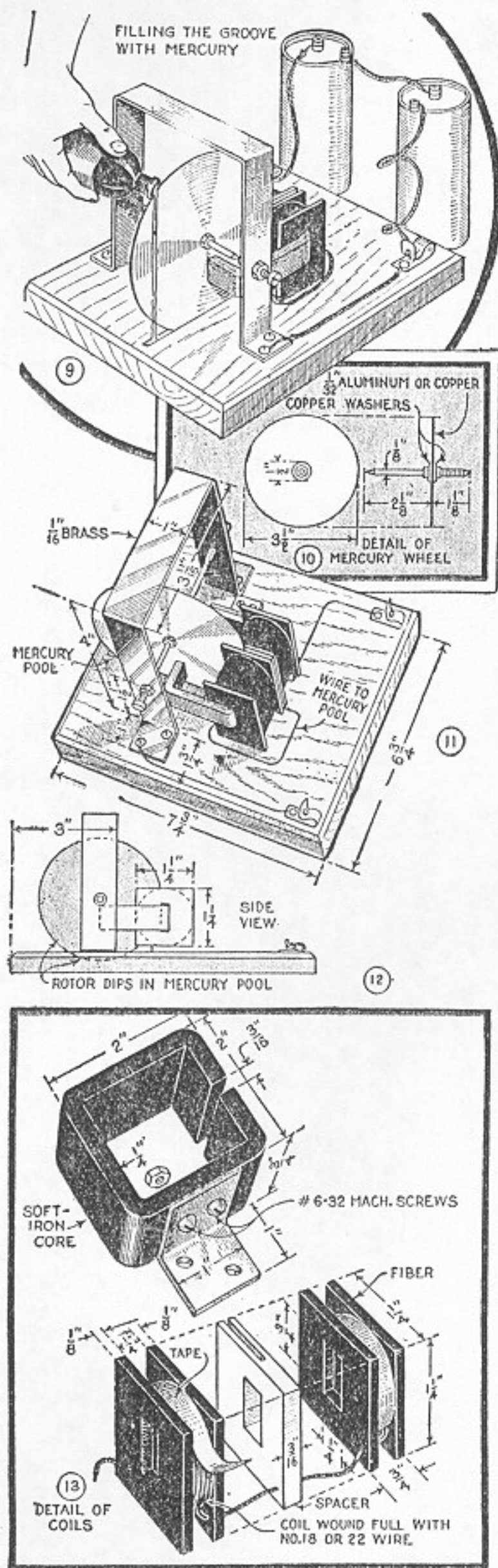
These simple electric motors, which run on low-voltage a.c. or d.c. as specified, are constructed from nails, wire and scraps of iron and tin. All of them have been built and made to operate; one provides ample power to drive small toys



the baseboard at point A, Fig. 6. At this point connections to a transformer or battery are made. The other end of the wire is tacked to the yoke that supports the upper end of the rotor. A length of bare copper wire is used as a brush, rubbing lightly against the edges of the rotor about $\frac{1}{2}$ in. above the base. It is formed to a coil to provide flexibility. The other end of the brush wire is bared and formed into a binding-post coil at point B to which the other side of the transformer or battery is connected. Center-punch marks are made in the yoke and in a small tin base plate, halfway between the two nails. Then the rotor is set in place so that the arms are about $\frac{1}{8}$ in. above the tops of the nails. The brush is adjusted so that it touches the edges of the rotor and also releases before the arms pass over the nail heads. After connecting the motor to the current supply, give the rotor a start by turning it and the motor should run.

Synchronous Motor: A synchronous motor is one that operates at a constant speed, which is equal to or a submultiple of the frequency of the alternating current supplied to it. A simple synchronous motor





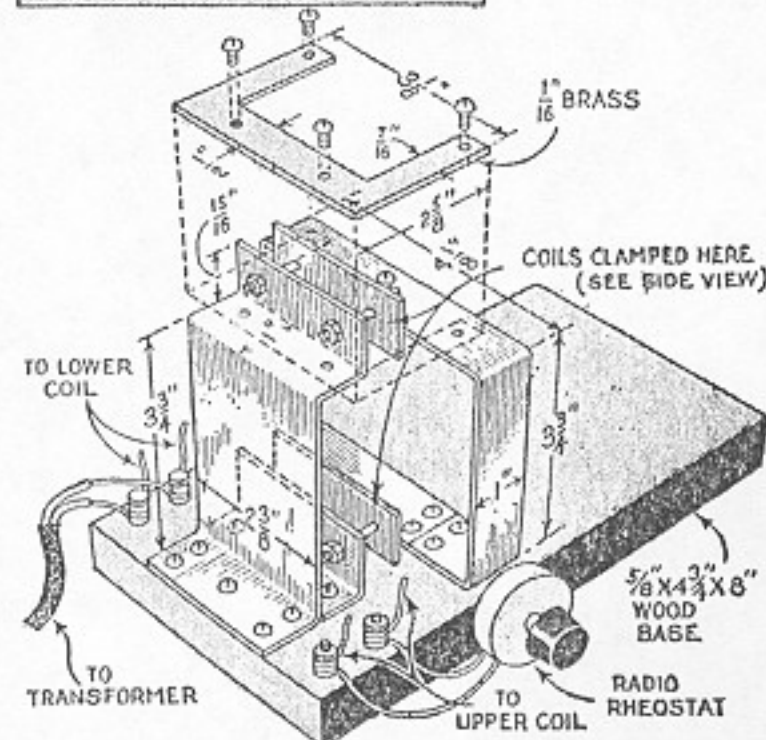
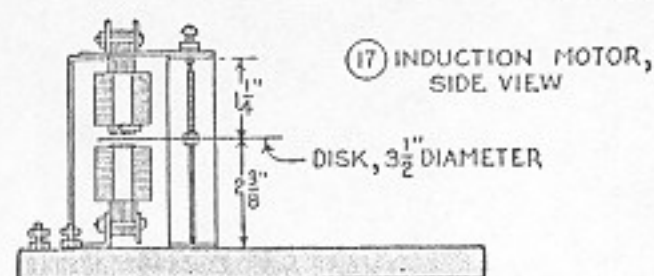
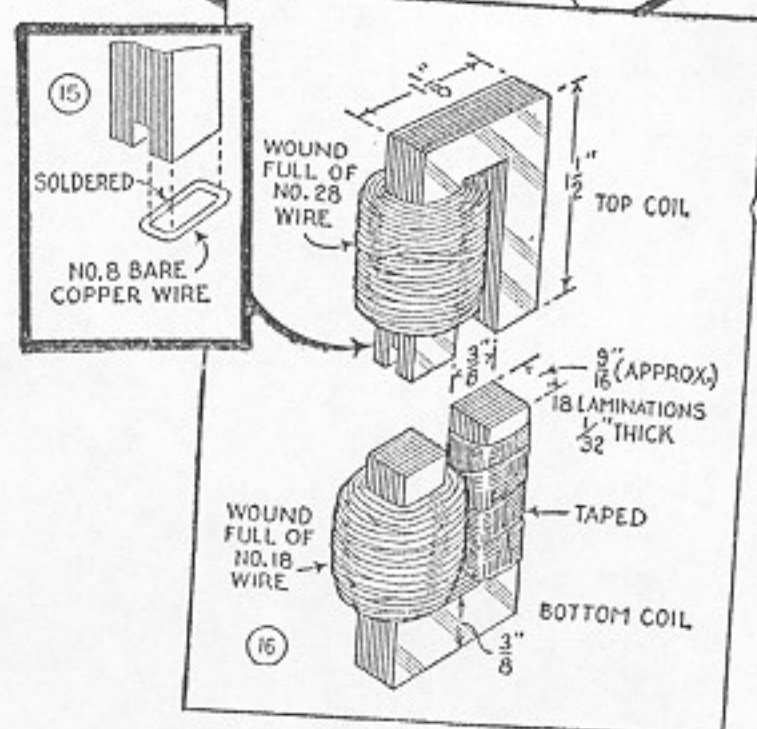
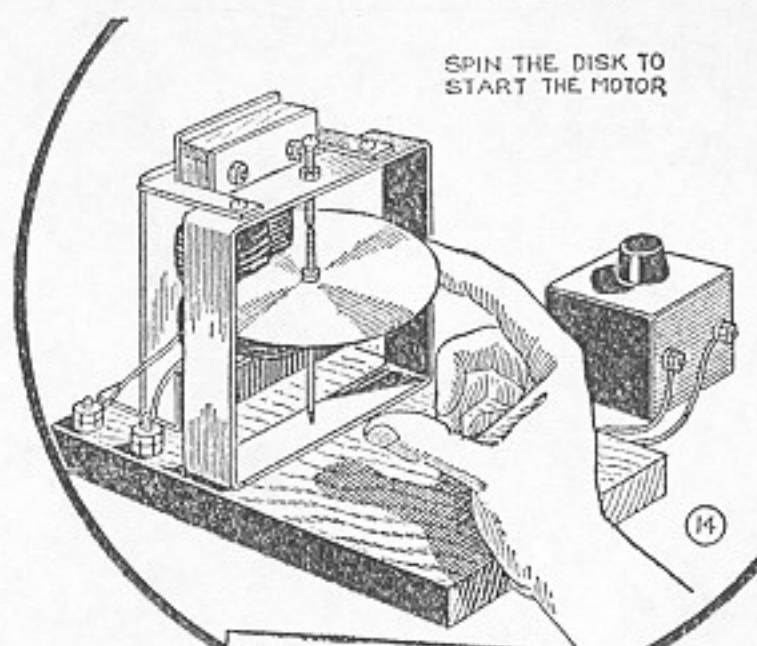
operating on low-voltage a.c. from a bell transformer is shown in Figs. 1 and 3. The field coils A and B are two magnets from a buzzer or doorbell placed so that the windings run in the same direction. These are connected in series. The rotor consists of two pieces of steel clock spring and the shaft is a No. 6-32 machine screw filed to a point at each end. Two nuts hold the springs to the shaft as shown. The shaft is pivoted between center-punched marks in the base plate and the supporting arm. There is no electrical connection to the rotor of this motor. The motor will continue to operate at about the speed at which it is started.

Series Motor: The motor shown in Fig. 5 runs on 6 volts d.c. or 8 to 12 volts a.c. from a toy transformer, and it can be fitted with a pulley to operate small models or other devices, delivering considerable power for its size. Details of construction are shown in Fig. 8. The armature and field cores C and D, as well as the end supports A and B, are made of $\frac{1}{8}$ -in. strap iron. Armature and field coils are wound with bell wire which approximately should fill the space. The armature is slipped on the shaft and is held in place by peening or with a drop of solder. The commutator is made from a thread spool and two strips of copper. Slots are sawed in opposite sides of the spool, the edges of the copper strips are inserted into the slots, and the strips are bent around the spools. There should be about $\frac{1}{4}$ to $\frac{3}{8}$ -in. clearance between the two copper segments. The edges of the commutator should be wrapped securely with strong cord. The leads from the armature coil are soldered to the two copper segments of the commutator, and the armature is put in place. Two washers are soldered to the shaft on either side of the end support to limit end play. The brushes are made of spring brass, $\frac{1}{2}$ in. wide. It may be necessary to give the motor a start by hand. If it does not run as first assembled, turn the commutator on the shaft to a position which will cause the motor to take hold.

Mercury-Pool Motor: The mercury-pool motor shown in Figs. 7 and 9 is a type used in d.c. watt-hour meters and other meters. It operates on two or three dry cells connected in series. It will not operate on a.c. Details of construction are shown in Figs. 9 to 13 inclusive. The rotor is a disk of $\frac{1}{32}$ -in. aluminum or copper mounted on a

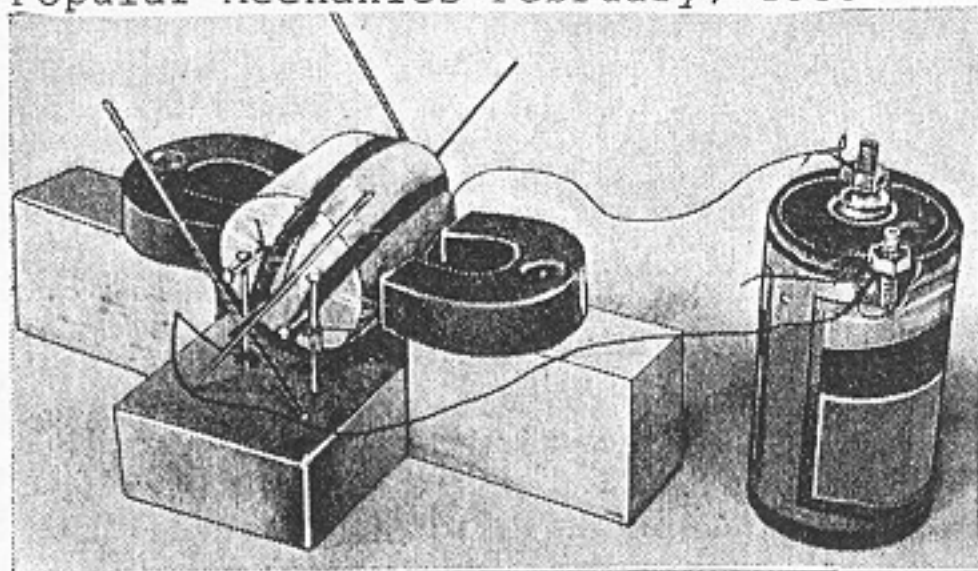
small shaft which is placed between two machine screws which are center-punched at one end to serve as bearings and are locked to the frame with nuts. The mercury pool is cut in the wooden base, directly under the rotor. Next, an electromagnet is made. The core is $\frac{1}{4}$ -in. flat iron bent as shown in Fig. 13 and the two coils are wound full of No. 18 or No. 22 magnet wire, a spacer being placed between them. Both coils must be wound in the same direction. The electromagnet is mounted so that the rotor revolves freely between the coils, and the poles of the magnet are directly below the shaft of the rotor. Electrical connections are shown in Fig. 11. One terminal is connected to the coil, and the other side of the coil is connected to a wire dipping into the mercury pool. The rotor also dips into the pool. The second terminal is connected to the frame of the motor.

Induction Motor: Operated on low-voltage a.c. from a toy transformer, the disk-type induction motor shown in Fig. 4 exemplifies a principle used in meters of various types. It will not operate on d.c. Details of parts are given in Figs. 14 to 17 inclusive. The laminations used are approximately of the dimensions shown in Fig. 17 and can be obtained from an old audio transformer used in radio. Two stacks of laminations, each $\frac{9}{16}$ in. thick, are required for the lower and upper coil. The upper coil is wound with No. 28 d.c.c. wire, enough wire being wound on the coil to fill the winding space on the core. The lower coil is wound with No. 18 wire. The leads from each coil are brought out to a pair of binding posts on opposite sides of the motor. The core of the upper coil is drilled directly below the coil and a single turn of No. 8 bare copper wire is inserted as shown in Fig. 15. The ends of this wire should be lapped carefully and soldered together. The frame is made of No. 16-ga. sheet brass. The rotor is a disk of sheet copper or aluminum. It is moved up or down on the shaft until it is in the proper position between the two cores. The upper coil terminals are connected to a radio rheostat and the lower coil is connected to the transformer supplying 6 volts. It will be necessary to shift the upper coil slightly to one side or the other in order to get the motor to operate properly. Once the proper position has been found, the speed can be controlled by adjusting the rheostat.



Fifteen Minutes to Build **this ELECTRIC MOTOR**

Popular Mechanics February, 1939



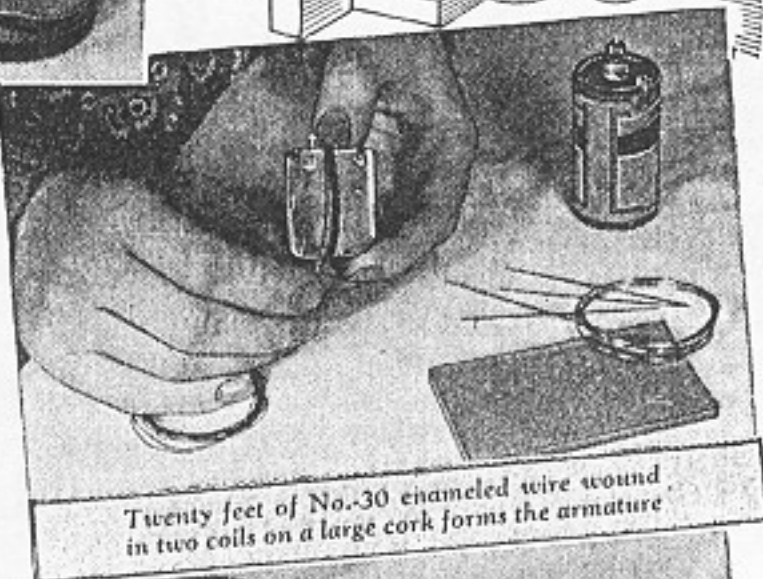
All ready to go! With horseshoe magnets acting as field coils a flashlight dry cell turns the armature at considerable speed

By J. P. DRISCOLL

YOU can make this tiny, simple motor from material available almost anywhere. If the motor has been properly assembled, a small dry cell of the flashlight type will provide sufficient current to run it at considerable speed. And, although the motor does not provide enough power to operate other toys, it is instructive to the junior electrician as it demonstrates basic laws of motor operation and will afford hours of fascinating play.

All you need is a large straight cork for the armature, two small horseshoe magnets to serve as the field poles, five darning needles for the shaft and shaft bearings, four pins to form a simplified commutator and brushes, twenty feet of No. 30 enameled magnet wire and three small wooden blocks.

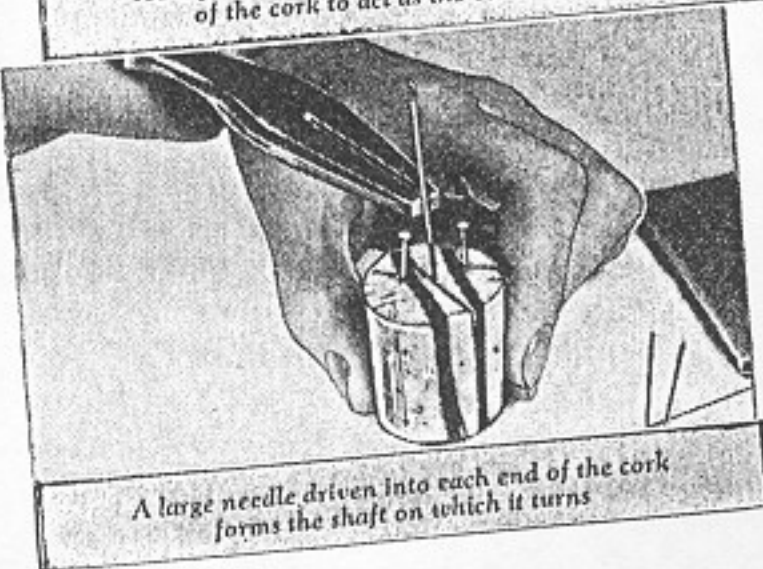
The first step is to drive two pins into the end of the cork diametrically opposite each other on a line marked on the end through the exact center. These pins must be located the same distance from the edge of the cork to keep the latter balanced as much as possible. When the motor runs, the pins on the armature revolve in the space between two pins driven vertically into a block, and must lightly wipe against the latter to permit electric current to be



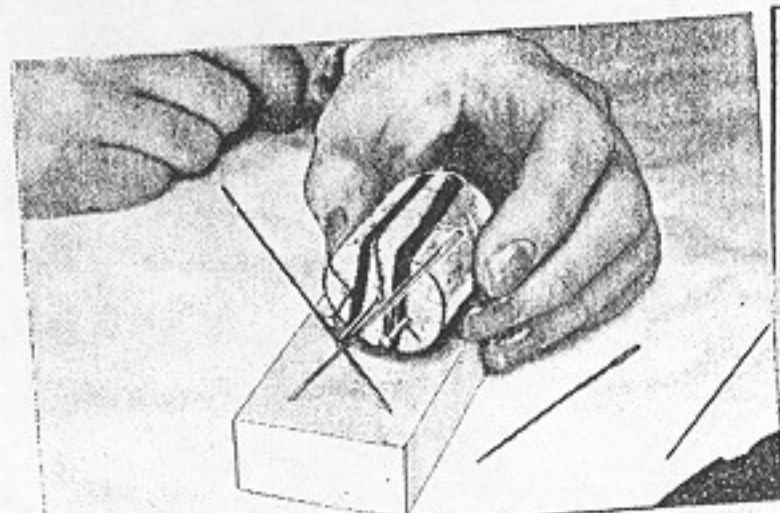
Twenty feet of No. 30 enameled wire wound in two coils on a large cork forms the armature



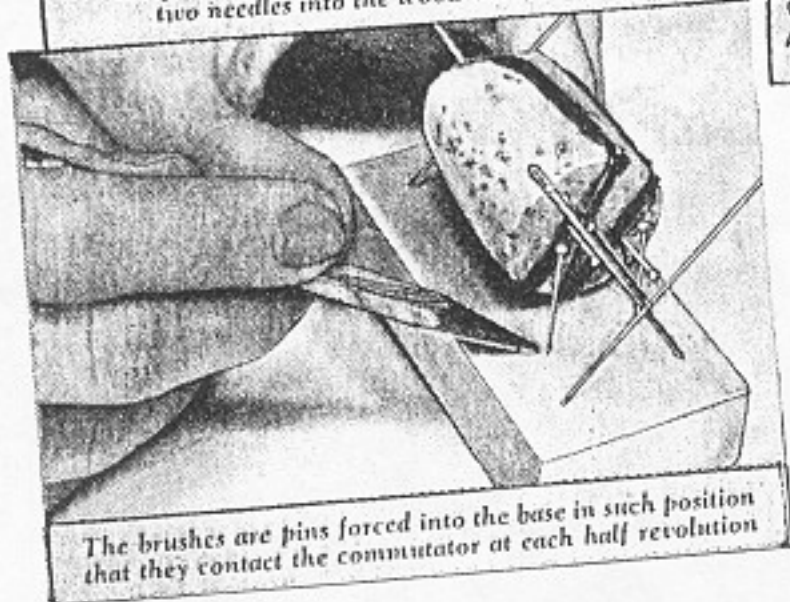
Here you see the two pins forced into one end of the cork to act as the commutator



A large needle driven into each end of the cork forms the shaft on which it turns

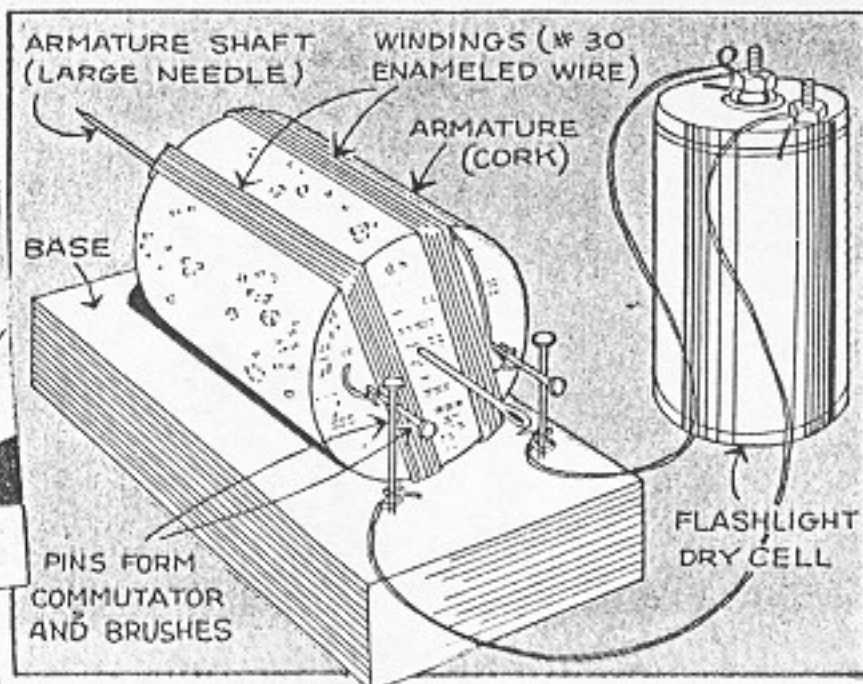


Simple non-friction bearings are made by driving two needles into the wood base at an angle



The brushes are pins forced into the base in such position that they contact the commutator at each half revolution

conducted to the armature winding, which is next wound on the cork in the position shown. Half of the wire is wound to form one coil, the wire is then crossed over and the winding continued in the same direction to form the second coil. It is important to get the same number of turns in each coil and to space the coils the same distance from the center of the cork in order to maintain balance. You can facilitate matters in this respect if you use a pencil and a ruler to lay off the location of the coils on both ends of the cork, just inside of the pins. Before winding, the end of the wire is scraped carefully for a distance of about one inch to remove all traces of the enameled covering. The cleaned end is wound around one pin to obtain good electrical contact and the winding is then started. Pushing a darning needle through the exact center of the cork as indicated, which can be done with a pair of pliers, provides the shaft and completes the armature assembly. Then two pairs of darning needles are forced into the armature support block to form bearings, each pair of needles crossing each other, making a crotch in which the armature shaft rotates.



The motor is now practically completed. You may snap a rubber band around the center of the cork to hold the coils in place as these might shift on account of centrifugal force when the armature rotates fast. Field poles are two small horseshoe magnets placed on wooden blocks set on each side of the armature. The pole faces of each magnet should line up parallel to the shaft and should be stationed as closely as possible to the side of the cork, allowing very little gap.

Before connecting the dry cell to the motor, you will have to examine and adjust the commutator and brushes. Only a slight wiping contact is required, and it is best to drive the brush pins lightly into the block so that there will be a little "give" when the commutator pins contact them. One dry cell is sufficient but greater speed is possible if two dry cells are connected in series. Direction of rotation is changed by reversing the connections to the dry cell.

POPULAR MECHANICS

July, 1939

Soap "Pencil" Relieves Itching of Mosquito Bites

Common yellow laundry soap moistened and rubbed over mosquito bites as soon as the wounds are made will relieve itching. One fisherman cuts pencil-shaped pieces from a soap cake and protects them with wrappings of gummed-paper tape, which can be torn off as the pencil is used.



Experiments with Toy Motors

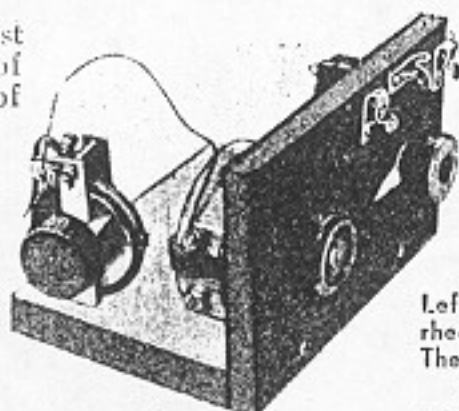
Science And Invention

November, 1930

By Raymond B. Wailes

The Author of this Article Is a Veritable Mine of Ingenuity in the Experimental and Home Work Shop Field. This Series of Toy Motor Experiments Will Attract Every Electrical Amateur Among Our Readers

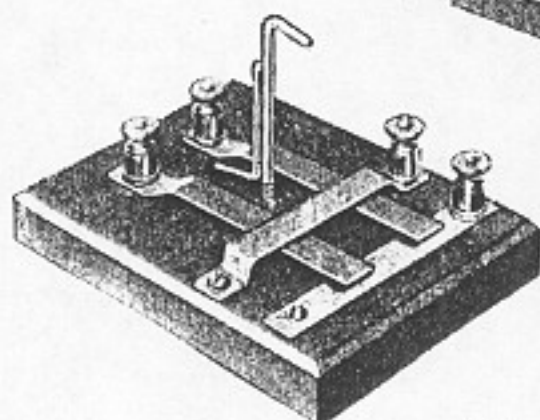
PERHAPS one of the first desires of the possessor of a battery motor is that of varying the speed of the motor. This was simply and easily accomplished by means of a rheostat inserted in series with one of the battery leads. Radio



Producing a musical note by blowing through the holes of a moving paper or phonograph disk.

Left—A series of obsolete radio rheostats arranged on a base. They are to be used to control the speed of a toy motor.

Below—Diagram of the reversing switch and method of connections.

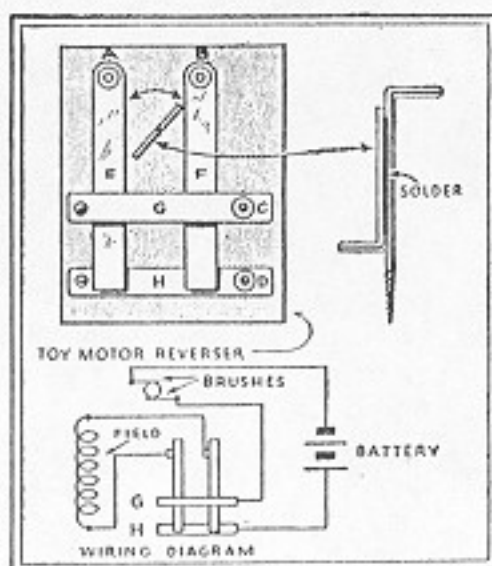
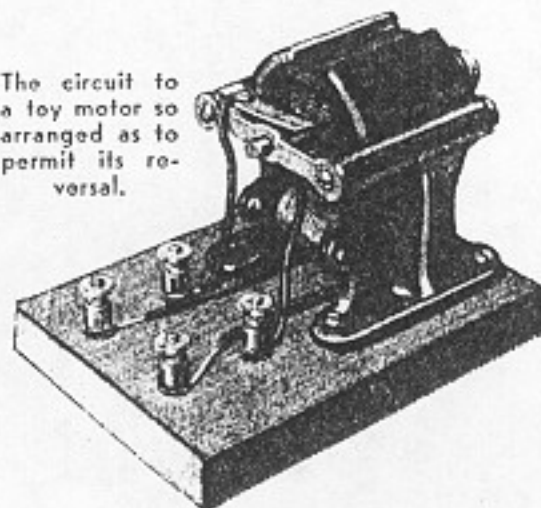


The completed reversing switch, made from a few metal strips, several binding posts and a wooden base

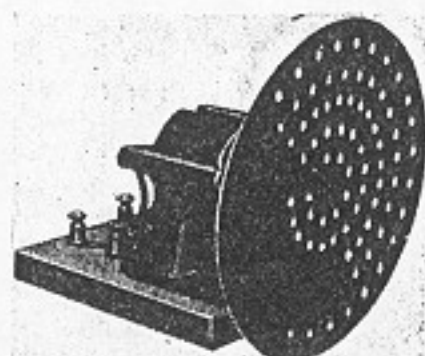
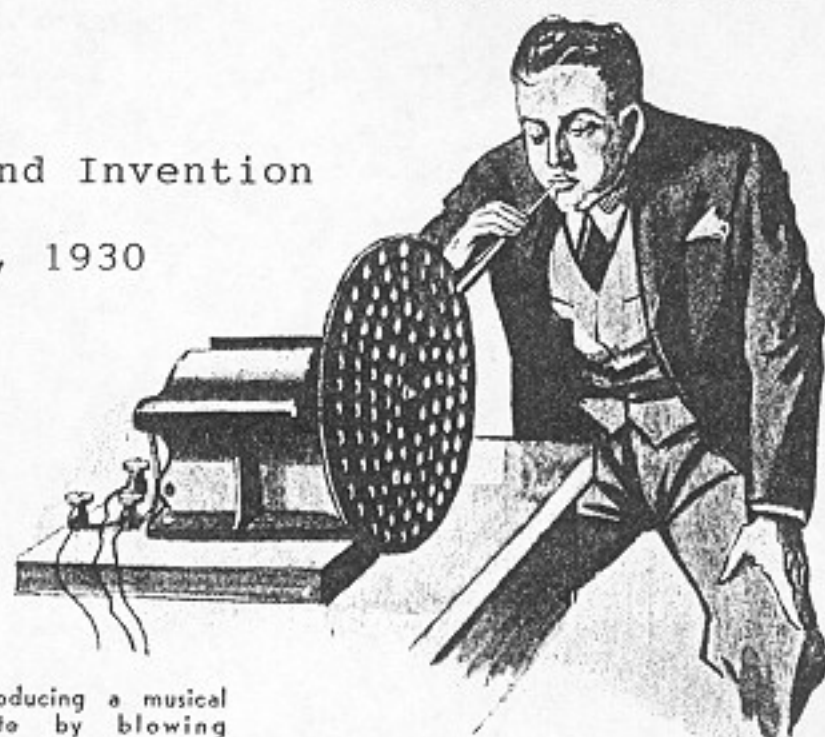
rheostats mounted on a wooden base or behind a wooden panel mounted upon a base make a serviceable resistance group by which motor speeds can be controlled.

That of reversing the motor is often a problem to some. Simply reversing the battery leads will not bring this about. However, by mounting the motor on a wooden base and fixing four binding posts upon the base, two posts being connected to the brushes and the remaining two to the field, results in a combination whereby the direction of rotation can be varied at will. In

The circuit to a toy motor so arranged as to permit its reversal.



making these connections, the present series field connections of the motor are abolished. In the series-field connection, one end of the field winding of the toy motor is connected to the battery, the other free end of the field winding connects with one of the brushes, and the remaining brush connects with the remaining battery terminal. In the four binding post method, the field to the brush wire should be disconnected. The now free wires should then be connected to two binding posts and the two brushes, connected electrically to nothing else, should be led to the other two binding posts. To operate the motor, run battery wire to one field binding post, the other battery wire to one of the brush binding posts and then connect the free binding posts with a wire. By a simple reversal of either ONE battery wire to the other corresponding connection, or end, and connecting directly the free binding posts, the motor will reverse.



Holes drilled in a phonograph record produce a musical note when a current of air is directed toward them through a soda straw or rubber tube, when revolving.

In this manner, the battery current reverses through either the field or the armature (through the brushes), but never reverses through both the field

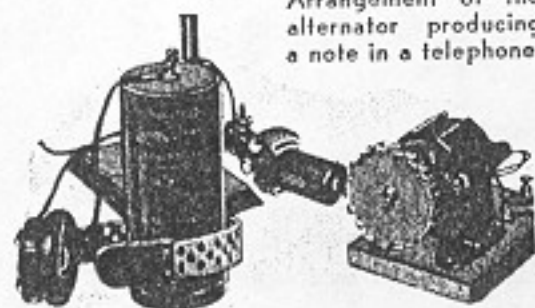
Rigging up a toy motor for operation from 110 volt lines.



and the armature at the same time to cause a different rotation.

A reversing switch can be made from copper strips. Bend and mount strips as shown in the sketch. Strips E and F are somewhat like telegraph keys and in the normal, or up, position make contact with strip G. When either one is depressed, this depressed strip makes

Arrangement of the alternator producing a note in a telephone.



contact with lower strip H. Each strip has a binding post mounted on it. Two L screw hooks soldered together make a neat handle lever by which either strip can be depressed and held in that position, by a simple motion of the handle hook to the left or right. If the connections are made as shown in the diagram, then depressing either key strip will cause the motor to turn left or right.

A motor fitted upon a base with four binding posts as described readily lends itself to being operated in alternating current. It will be found that if the field winding or coil is connected in series with an electric lamp and the 110-volt alternating current circuit, that the lamp will light. If a radio rheostat

is connected across the brushes or armature circuit, the motor will revolve, if the rheostat is regulated.

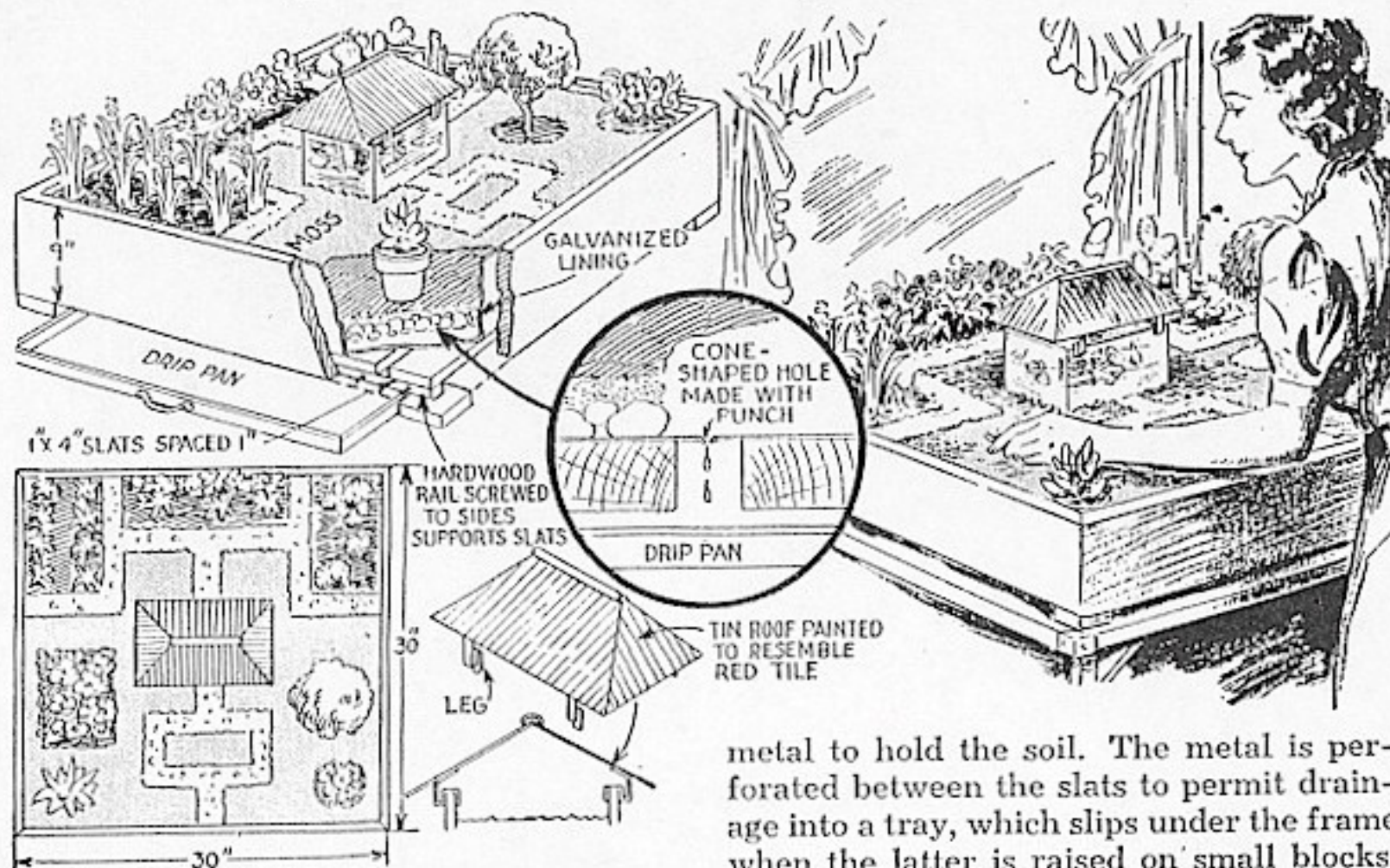
A paper or cardboard disc perforated with holes as illustrated in one of the photographs shows how one can make a wind siren. On whirling the disc with the motor and blowing through a rubber tube or soda straw through the rotating holes in one of the concentric perforations, a musical note can be heard. On allowing the air stream to strike another circle of perforations, a different note will be produced.

A miniature alternator can be made by mounting a circular iron (such as a galvanized iron) disc on the motor shaft. The circular disc should be cut at a point every quarter of an inch

along the circumference, a quarter of an inch in toward the center. Each alternate segment thus formed should be bent toward the same side of the disc as shown in the photograph. By connecting a battery in series with an electromagnet and placing the magnet so that the pole is very near the revolving segments of the disc, a hum can be heard in the telephone receivers. This is due to the magnetic lines of force of the magnet being cut or altered by the revolving segments, the segments soaking up, as it were, some of the magnetic lines at a time when a segment is in close proximity to the pole of the electromagnet.

Popular Mechanics January, 1939

Table-Top Garden for Apartment Dwellers



Even with limited space, city dwellers can enjoy plants and flowers indoors with this miniature table-top garden. It can be laid out in formal plan with geometric walks and beds, or it can be developed into an old-fashioned type. The garden comprises a mitered frame with a slatted bottom. The slats and inside surfaces of the frame are coated with tar, after which the frame and bottom are lined with sheet

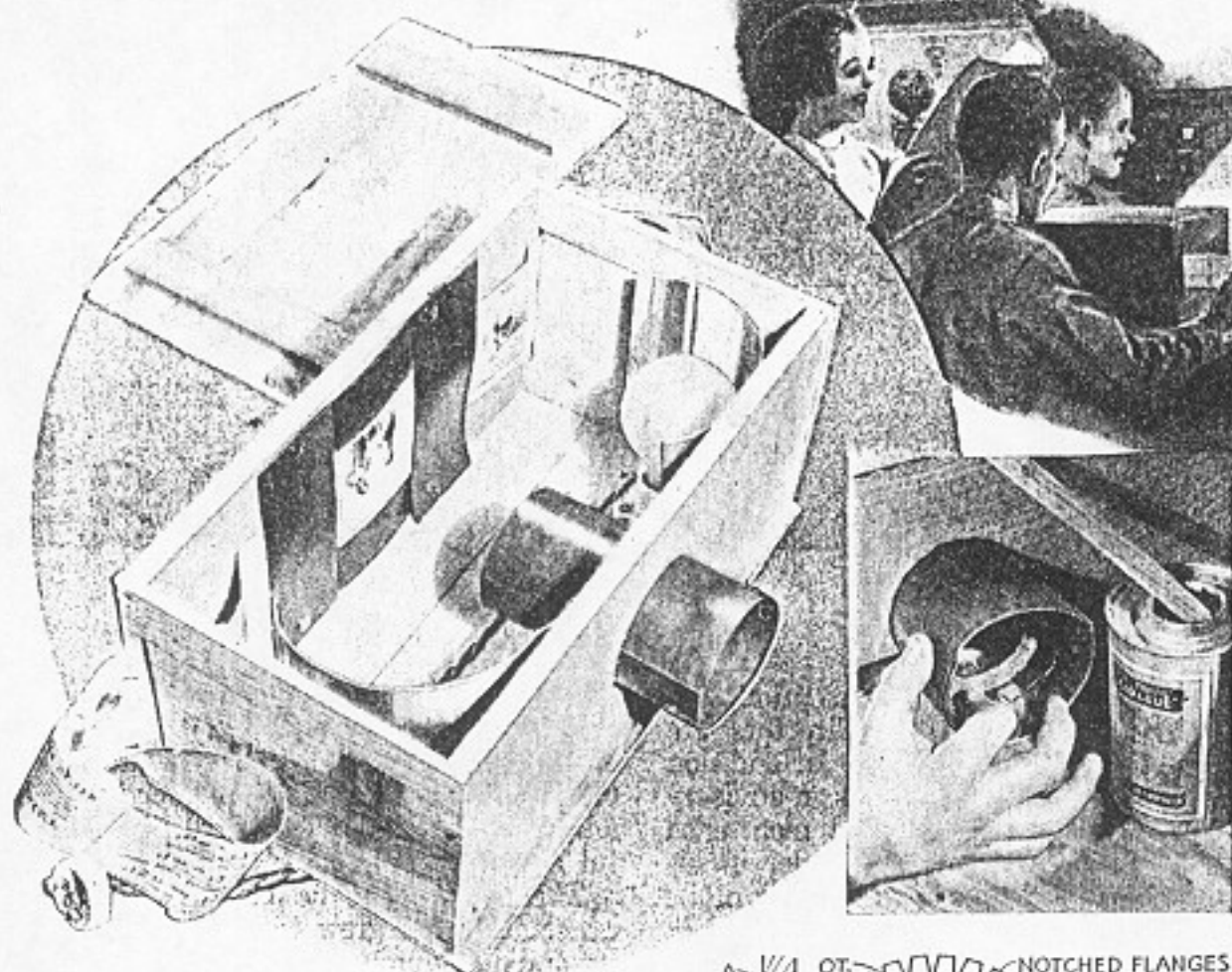
metal to hold the soil. The metal is perforated between the slats to permit drainage into a tray, which slips under the frame when the latter is raised on small blocks. To prepare the garden, spread small stones over the bottom, then cover with cinders or sand. Potted plants are used, and rich soil is packed around them. Lay out the walks with clean fine-mesh gravel, and plant grass or Helexine moss in spaces between the pots. An aquarium makes an attractive center piece, and if rectangular in shape, it can be made to resemble a glass house by providing a tin hip roof. Paint the roof to resemble red tile.

Comic-Strip "Talkies"

GIVE CHILDREN ENDLESS FUN AT HOME

By Morton Bartlett

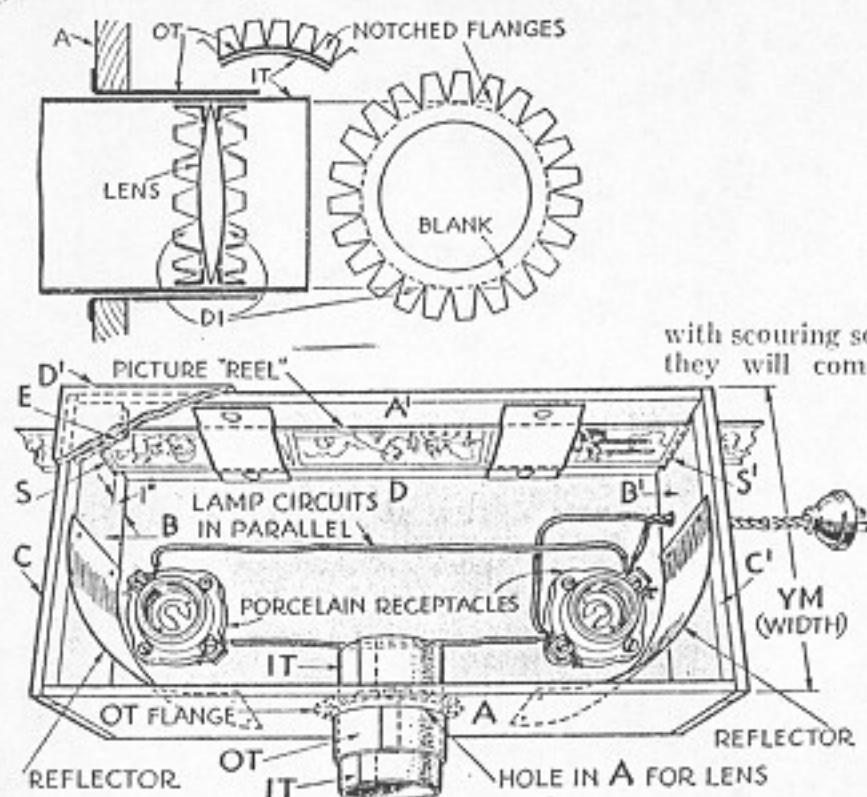
Popular Science DECEMBER, 1933



The magic lantern is built of odd and ends, and has a magnifying or reading glass as a lens. Two 100-watt lamps provide the light.

UNIQUE comic-strip "talkies" can be given in your own home at trifling cost. The pictures are thrown upon a screen by means of a simply made magic lantern, and the children speak the lines of the various characters through a home microphone connected to an ordinary radio receiving set.

The materials are listed on page 85. The first step is to make the lantern. Its width is equal to the focal length of the magnifying glass which will be the lens. Determine this by tacking a piece of paper against the wall 10 ft. from a lighted lamp. Hold a ruler perpendicular to the paper, and run the lens, perpendicular to the ruler, along the inch marks. At some point a clear image of the lamp will be seen on the paper. The focal length may now be read from the ruler. This distance is the dimension *YM* in the drawings. Having found this basic dimension, cut ten pieces of wood as specified in the list.



Cut a round hole in the center of piece *A* to receive the lens assembly. Its diameter is the diameter of the lens, frame removed, plus the thickness of five pieces of fiber board.

Assemble pieces *D*, *A*, *A'*, *B*, *B'*. Make

Speaking into a home microphone, the children take the parts of the comic characters.

the saw cuts indicated by *S* and *S'* flush with the back and 5 in. long. *C* and *C'* are now nailed, and nails are run through them into the two unsecured corners of *B* and *B'*. The top is left separate to allow access to the interior. Ventilation need not be considered as plenty of air will circulate through the cracks.

The reflectors are tin cans. Remove tops and bottoms, split up the sides, and spread open enough to fit them into the front corners of the lantern. Polish them

with scouring soap, and secure in place so that they will come directly behind the bulbs.

Screw the lamp receptacles just far enough from the tin to permit inserting the bulbs without letting them touch at the sides. Wire the receptacles in parallel.

To make the mount for the lens, cut a piece of the fiber board 2 by 3½ times the diameter of the lens. Round it into a tube

(marked *IT* in the drawings) in which the lens fits snugly, and glue the seam. Make two diaphragms *DI* for the lens of the same material as the tubes, cutting them as shown. The diameter of the circle encompassed by the dotted line is exactly the diameter of the lens and that represented by the solid line, $\frac{1}{2}$ in. less. The tabs are $\frac{1}{2}$ in. long. Insert tube *IT* in the hole in the front of the lantern to hold it steady as you place the lens and diaphragms as shown in the cross-section drawing and one of the photographs.

The outer tube (marked *OT*) is also cut from the fiber, measured off $\frac{1}{4}$ in. longer than the flat dimension of *IT*, and 1 in. narrower. Cut $\frac{1}{2}$ -in. tabs along the entire length of one side. Bend it firmly around *IT* and glue the seam. When dry, insert it in the hole in the lantern, tabs toward the inside. Bend the tabs and tack them to the wood. Tube *IT* should be able to slide easily within *OT*.

The last step is to make the "reel." Cut the comics into strips, leaving a $\frac{1}{2}$ -in. margin at the left-hand end of each. The margin on each new strip will go under the close-cut end of the preceding. A leader—a paper strip 1 ft.

long—is pasted on the left of the completed reel; when the reel is rolled up, this leader will be on the outside. It is fed through slot *S* and out through *S*¹, with the pictures upside down. To keep the pictures flush with the back of the lantern and in focus, it is most convenient to cut two pieces of the fiber 7 by 3 in. These are curled a bit and thumbtacked in place over the strip.

For a test showing, suspend a sheet in front of the radio, place the lantern about 8 ft. away, darken the room, and light the bulbs. Slide the lens back and forth until the image is clear and sharp. Experiment with the lantern at different distances.

For the reading of the parts, it is most convenient to buy a second copy of the paper. Although the entire picture is shown on the screen, the audience will not read the lettering, which is all reversed.

Hook up the microphone according to the instructions coming with it, carry it to the actors, who should be stationed beyond sufficient sound insulation so that there will be no tendency for the radio set to start "howling," and make a final test. Speak clear-

ly, not loudly, with the mouth about 6 in. from the instrument.

List of Materials

About 4 sq. ft. of any lumber cut into ten pieces as follows:

D, D¹ 13 in. by 1 in.
A, A¹ 7 in. by 13 in. less twice the thickness of the wood used
B, B¹ 6 in. by 1 in.
C, C¹ 1 in. by 1 in.
E, E¹ $1\frac{1}{2}$ in. by 1 in. less twice the thickness of the wood used

2 tin cans

2 flat-base lamp receptacles

1 magnifying glass at least 2 in. in diameter

Some flexible cardboard or bookbinder's fiber board

Lamp cord and connecting plug

2 lamps, 100-watt

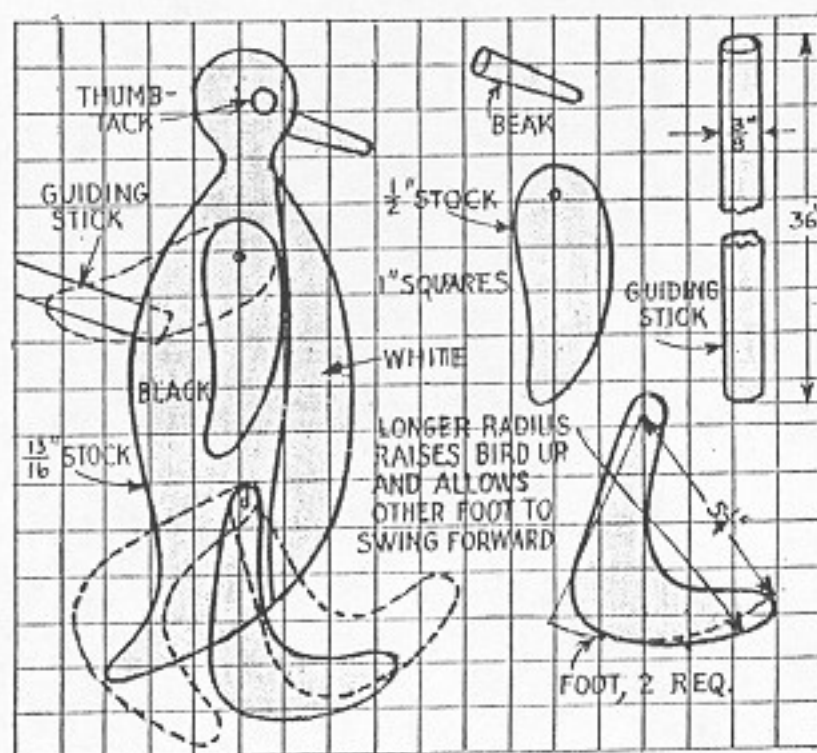
Sheet to serve as a screen

1 home-broadcasting microphone (costing in this case 55 cents)

Radio receiving set

POPULAR MECHANICS February, 1939

Wood Penguin Waddles in Lifelike Manner



Although he's remarkably realistic in color, size and also in his manner of getting about, this penguin is made of wood and is pushed with a stick. Body and head are shaped from one piece of $1\frac{3}{16}$ -in. plywood while the wings and legs, or feet, are separate parts cut from $\frac{1}{2}$ -in. material and pivoted to the body. The curve of the feet is the important thing as it is this curve which allows the penguin to walk in a lifelike manner. Of course, the feet must be pivoted so that they swing freely. This is done by drilling an oversize hole in each leg for a round-headed screw. A thin washer is placed over the screw between the leg and the body and also under the screw head. The wings can be pivoted in the same way.

—Dick Hutchinson, Ithaca, N. Y.

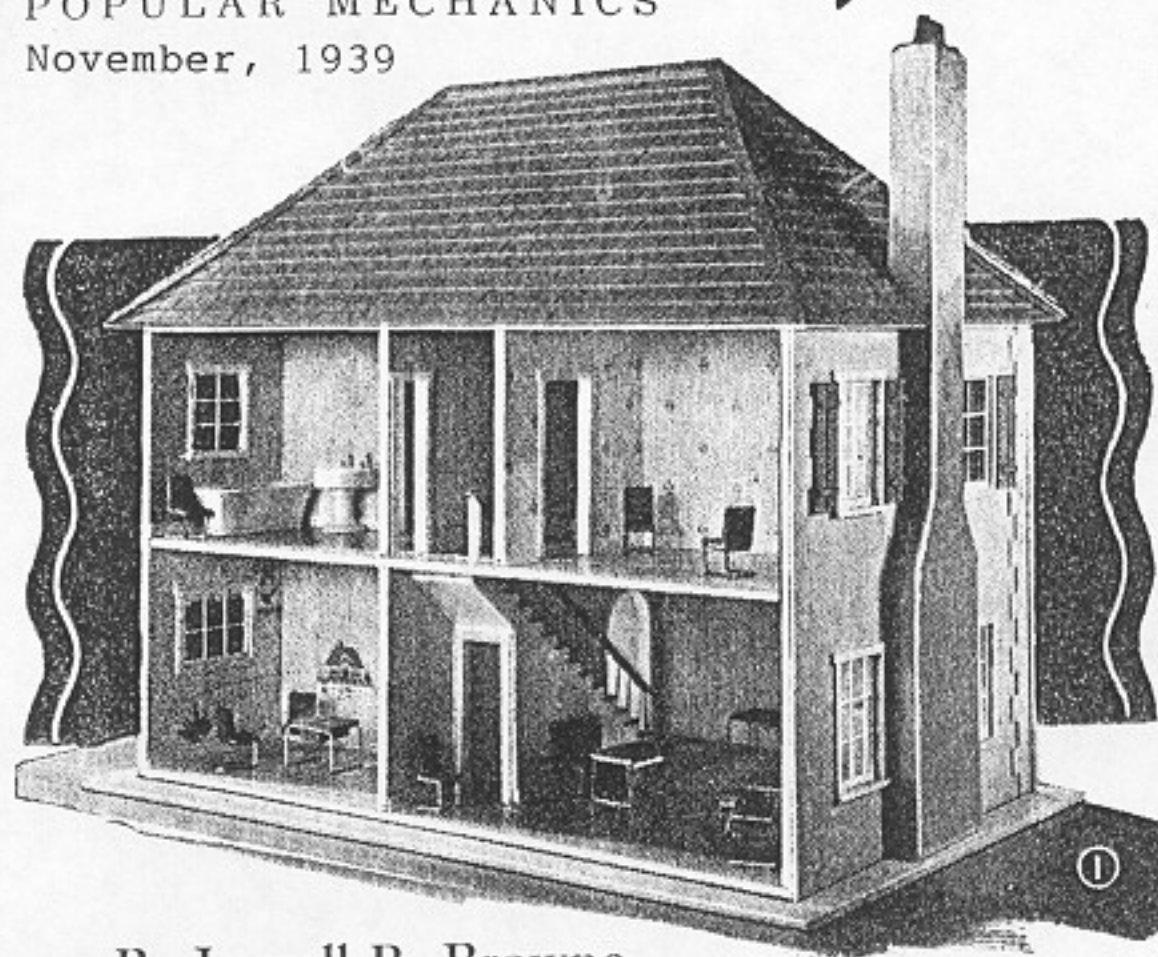




POPULAR MECHANICS

November, 1939

Starting Early on the



Built of plywood, this roomy, substantial doll house in French chateau style may be wall-papered or painted inside; has "stucco" outside walls with "stone" corner trim, realistic celluloid window panes, a cozy fireplace, and it can be wired for tiny lights. Front door, under curved balcony, has a real latch and hinges. Entire front and back are removable for easy access to the interior

By Lowell R. Browne

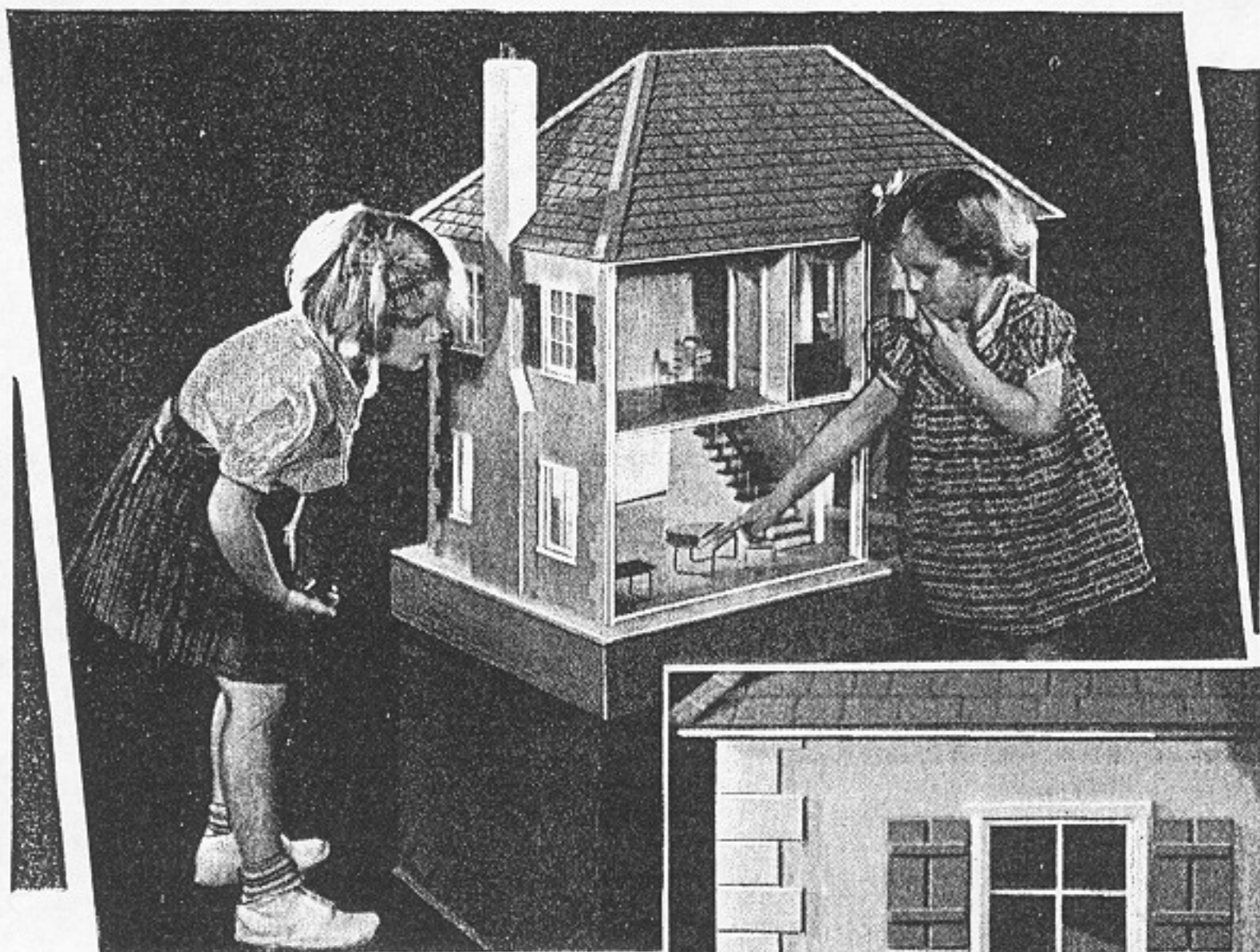
A MODIFICATION of the clean-cut French chateau style of architecture presents a pleasing design for this doll house, Fig. 1. It has three bedrooms and bath in addition to upstairs hall, kitchen, dining room and a living room the full width of the house. All windows are fitted with sash, celluloid panes and shutters, and the front door has a real latch. Floors are in natural finish and each room is papered. If desired, the structure may be simplified considerably by eliminating the window sash, stair rail and treads, wallpaper, baseboards and casements, if a very simple shelter for dolls and furniture will suffice. With the exception of shingles, chimney and trim, construction is of $\frac{3}{8}$ -in. plywood throughout. Use only the best grade, sand-papered on both sides. Both front and back are detachable, Figs. 5 and 7, to give access to the rooms on each side of the house.

Walls and Partitions: Exact sizes of walls and floors are shown in Figs. 3, 4 and 6. First, second and attic floors are identical except for the stair-well cut in the second. Front and back are the same size, and if you care to go to the additional work, windows and a door may be cut in the back, to correspond to those in the front. To

standardize the work, the first and second floors are made the same height, although in full-size houses the second floor ceiling is usually lower than the first. Dimensions and location of the partitions are given in Fig. 6. Each partition has its individual letter to make it easier to follow assembly.

Assembling the Structure: The cut-away perspective drawing, Fig. 3, gives a clear picture of assembly of walls, floors, roof, cornices, etc. It is important that all walls, etc., be as square as possible. Join them with No. 3 flat-head screws after having applied casein glue to the joints. The screws should be countersunk. Note that upstairs partition "D" is directly over partition "B," hence it is impossible to put screws into both. The choice is given to the lower partition, with casein glue for the upper, aided by the weight on this member. Roof supports, "G" and "H" set down inside the cornice, and the chimney is not installed until the roof, before shingles are laid, is on. Cornices at the ends are slightly different in section from those in front and back, Fig. 8. This is due to the detachable front and back walls, which fit into a shallow rabbet along the top. The plywood roof rests directly upon the

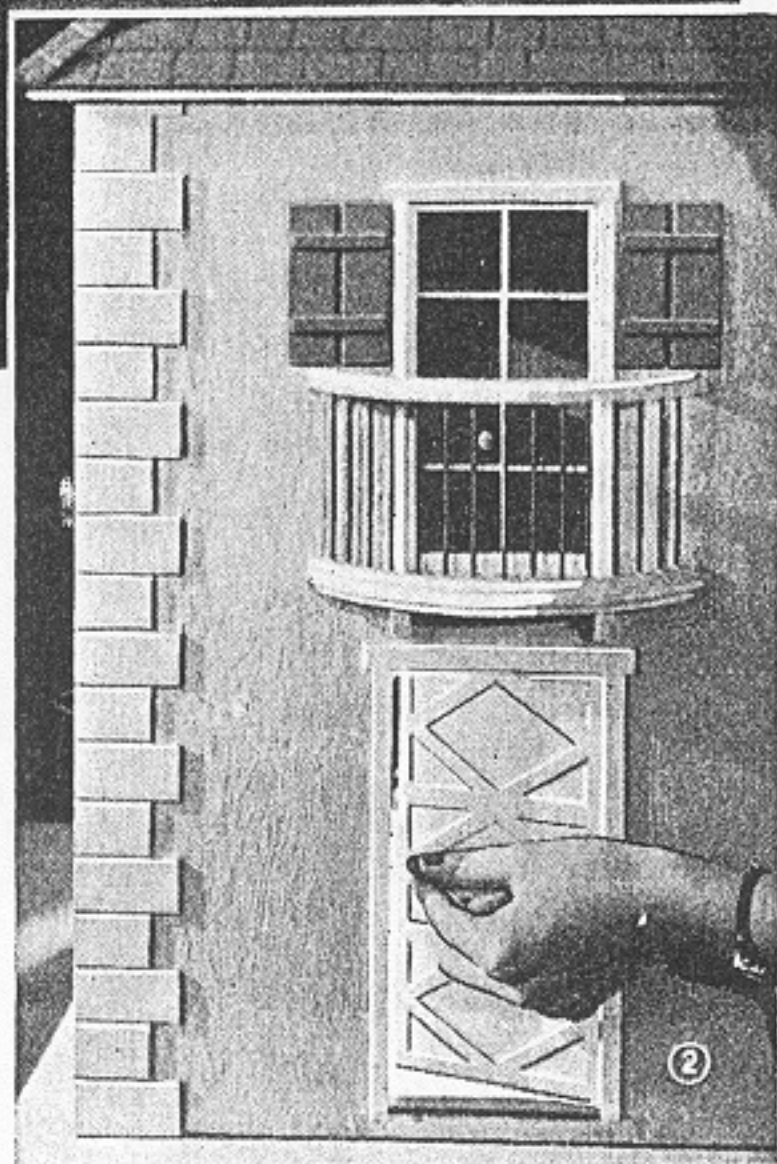
Christmas DOLL HOUSE



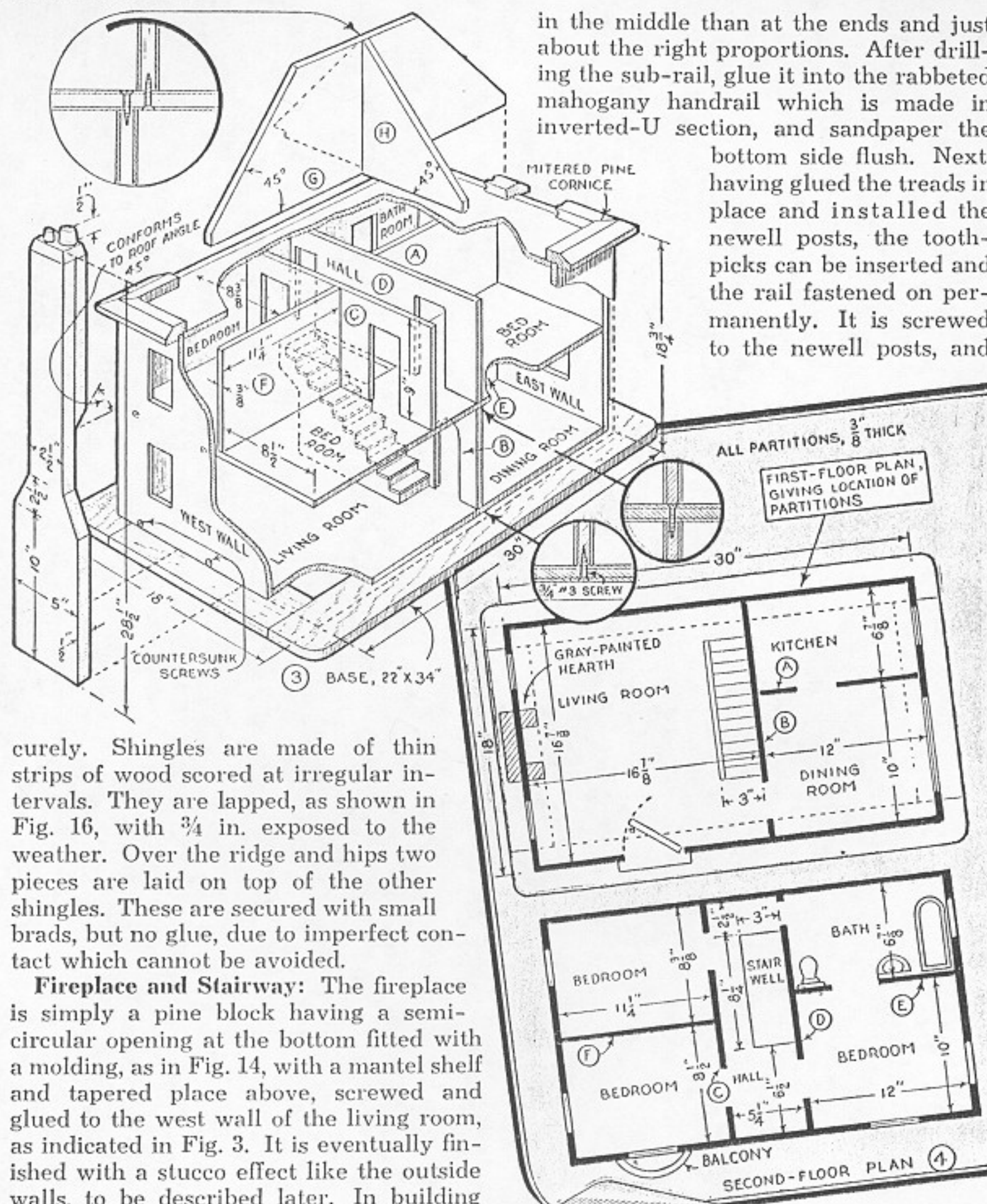
cornice, and is screwed down upon the supports "G" and "H."

Detachable walls swing out from the bottom, and no catch is provided to hold them in as such devices are troublesome for very small children. Instead, a thin strip of rubber is cemented at each end on the lower corners. These tend to hold the wall in the proper position. Exact dimensions of the four pieces of plywood composing the roof sheathing are given in Fig. 16. These are beveled along the edges on the underside, taking a 45-degree angle along the horizontal edges, and less at the hips. It is inevitable that some trimming will be necessary at the latter joints unless one can cut the plywood "geometrically perfect."

For the imitation stone work on the corners of the building, scroll-saw a thick piece as shown in Fig. 7 with 1-in. notches $\frac{1}{2}$ in. deep. Then rip it into $\frac{1}{16}$ -in. strips. These in turn are lightly scored with a circular saw to indicate mortar joints between



the blocks. Note that to preserve the same proportions on front and side walls, a strip the width of the plywood is ripped and glued to the edge. In gluing pieces together, it is understood that the wood is unpainted. Otherwise it will not hold se-



curely. Shingles are made of thin strips of wood scored at irregular intervals. They are lapped, as shown in Fig. 16, with $\frac{3}{4}$ in. exposed to the weather. Over the ridge and hips two pieces are laid on top of the other shingles. These are secured with small brads, but no glue, due to imperfect contact which cannot be avoided.

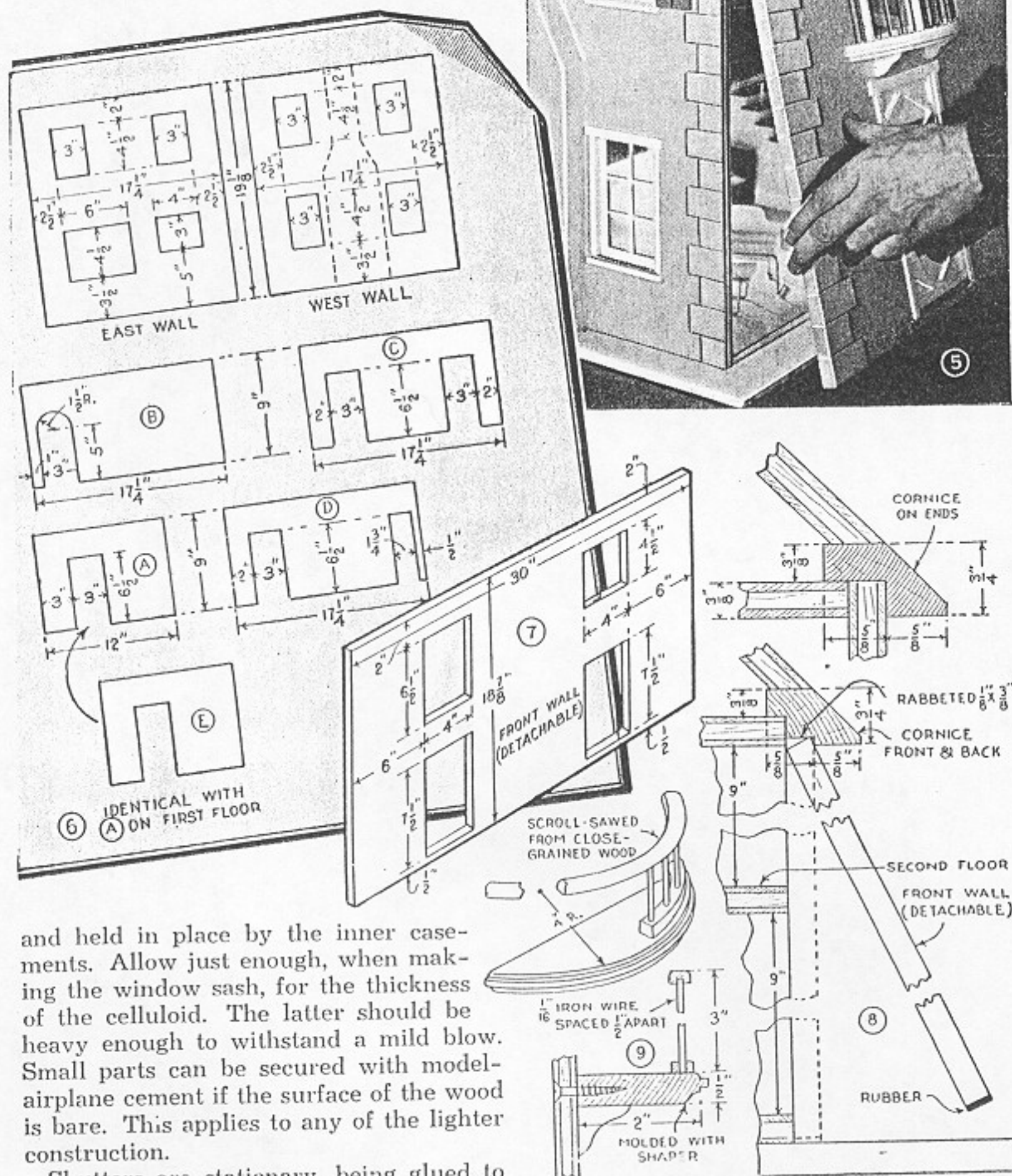
Fireplace and Stairway: The fireplace is simply a pine block having a semi-circular opening at the bottom fitted with a molding, as in Fig. 14, with a mantel shelf and tapered place above, screwed and glued to the west wall of the living room, as indicated in Fig. 3. It is eventually finished with a stucco effect like the outside walls, to be described later. In building the stairway, two side members are cut with the steps and joined with a piece of wood in between, as shown in Fig. 13. One wall is then screwed and glued to the partition "B." Before installing the stairway permanently, all the mahogany treads are made and an inner or sub-handrail is clamped over them, and each step is drilled through the latter for the spindle. Round, tapered maple toothpicks are just the thing for the spindles, as they are thicker

in the middle than at the ends and just about the right proportions. After drilling the sub-rail, glue it into the rabbeted mahogany handrail which is made in inverted-U section, and sandpaper the bottom side flush. Next, having glued the treads in place and installed the newell posts, the toothpicks can be inserted and the rail fastened on permanently. It is screwed to the newell posts, and

wood plugs are set over the countersunk screw heads. Before final assembly, all the white painting should be completed on the stairway walls and spindles, and mahogany treads and rail stained and shellacked. Construction of the stairway leaves a handy coat closet underneath, reached through a door in the rear.

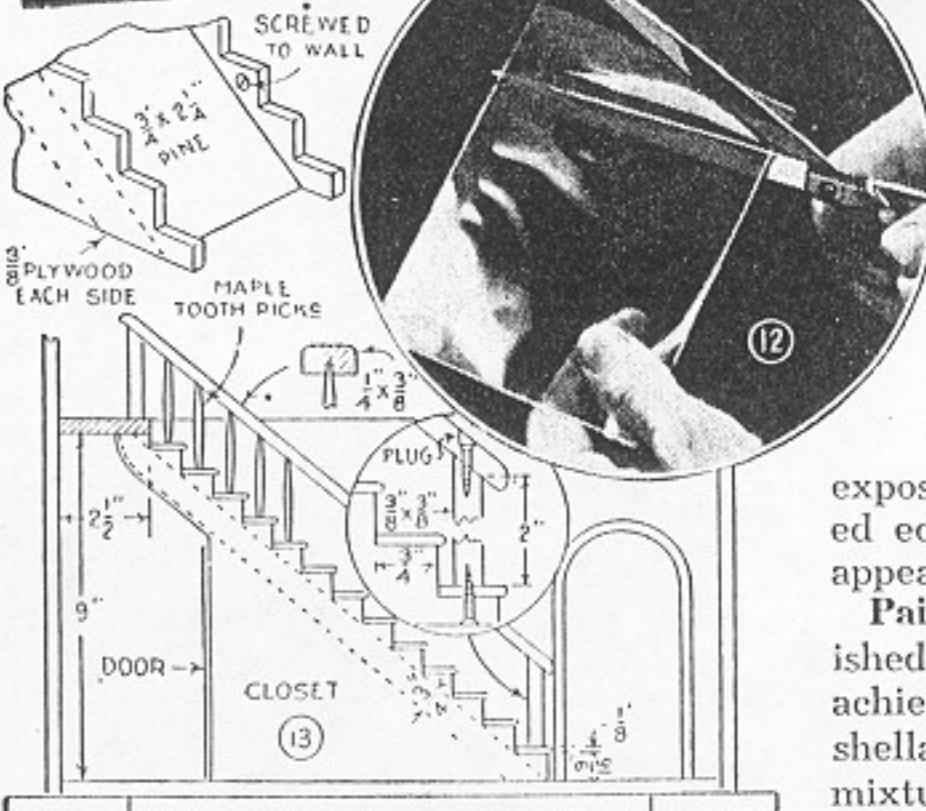
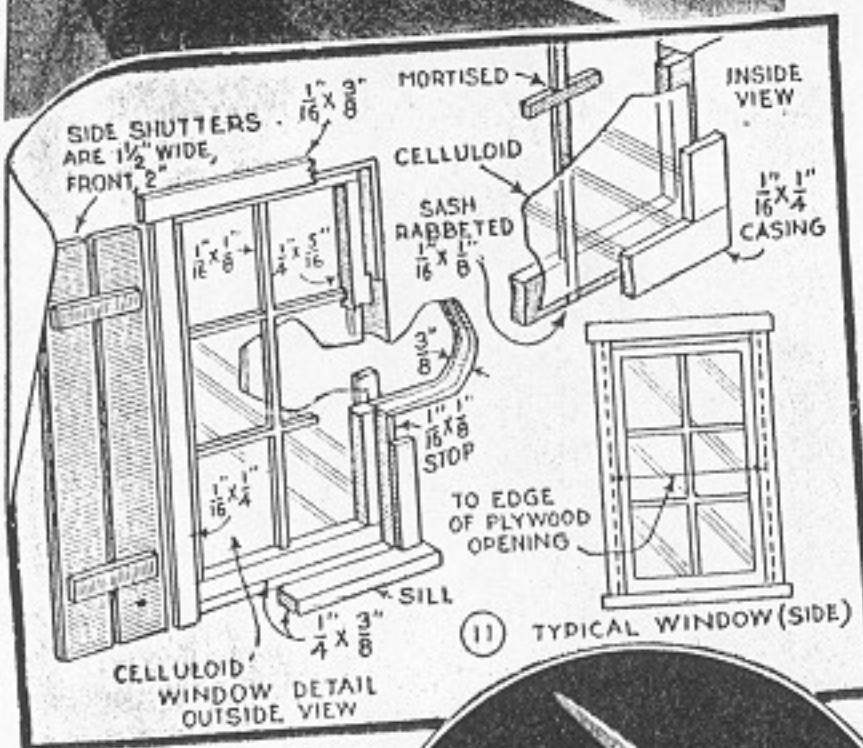
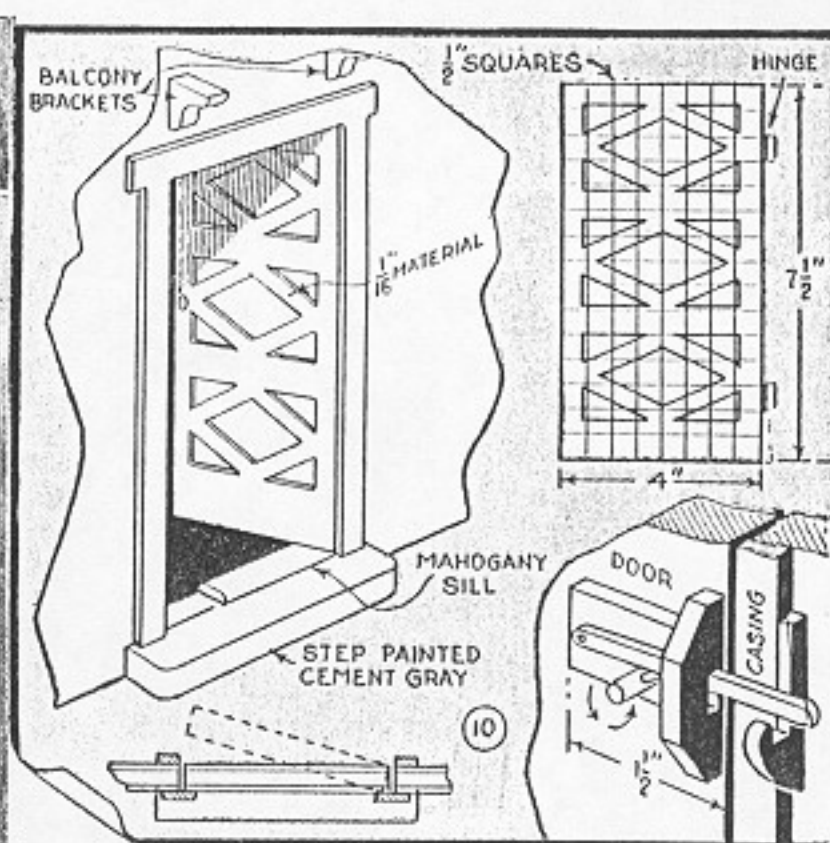
Windows, Doors and Balcony: The original doll house shown in the illustrations

is fitted with complete sash and celluloid panes, a typical example being illustrated in Fig. 11. First a stop-batten is set inside the window opening and glued to the plywood. Casement pieces are lapped flush over this on the outside and a sill installed as shown. The sash is made of pine with the mullions rabbeted into the side, top and bottom members and mortised together where they cross. This makes the entire inner side flush and ready to receive the celluloid pane, which is cut as in Fig. 12



and held in place by the inner casements. Allow just enough, when making the window sash, for the thickness of the celluloid. The latter should be heavy enough to withstand a mild blow. Small parts can be secured with model-airplane cement if the surface of the wood is bare. This applies to any of the lighter construction.

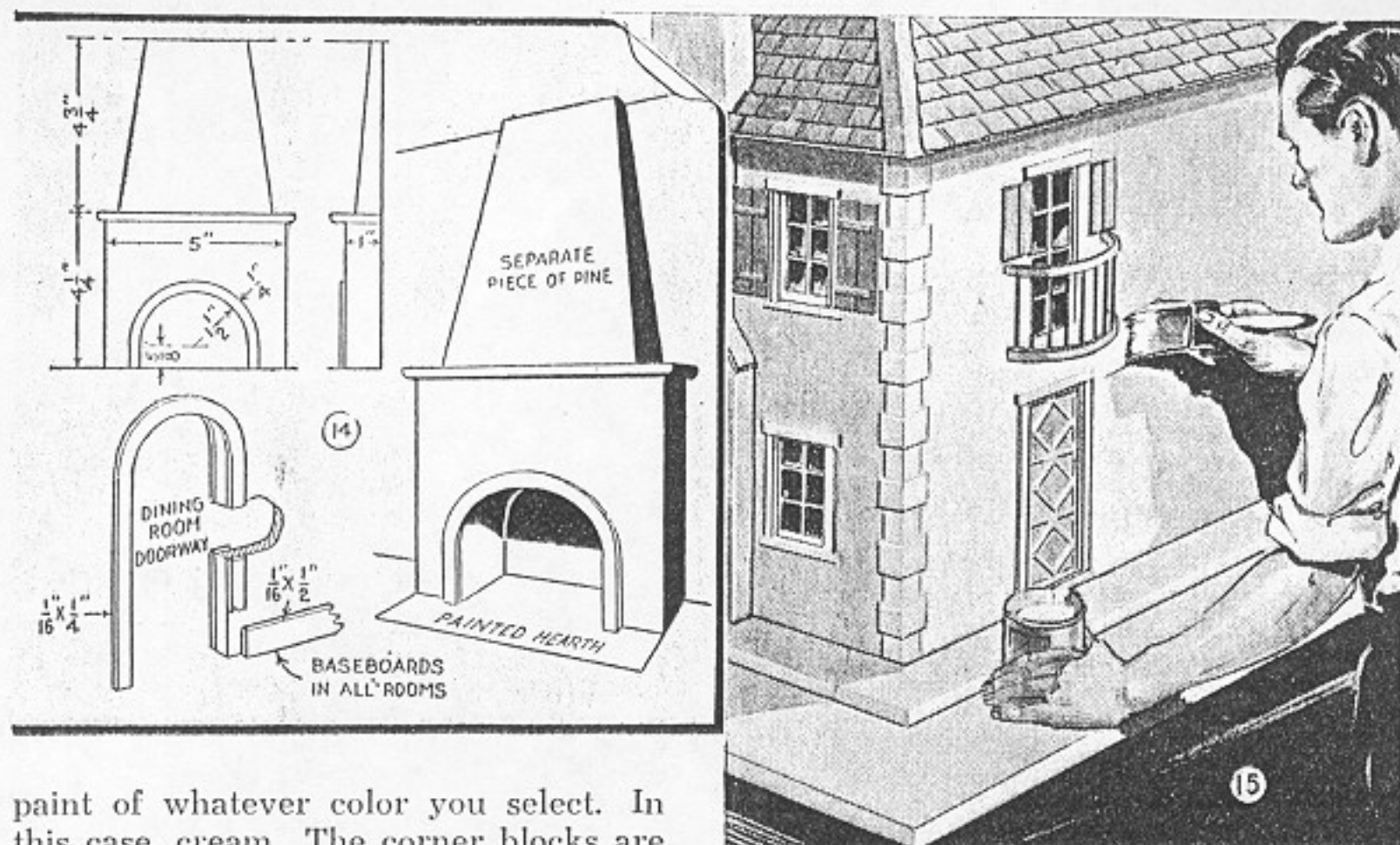
Shutters are stationary, being glued to



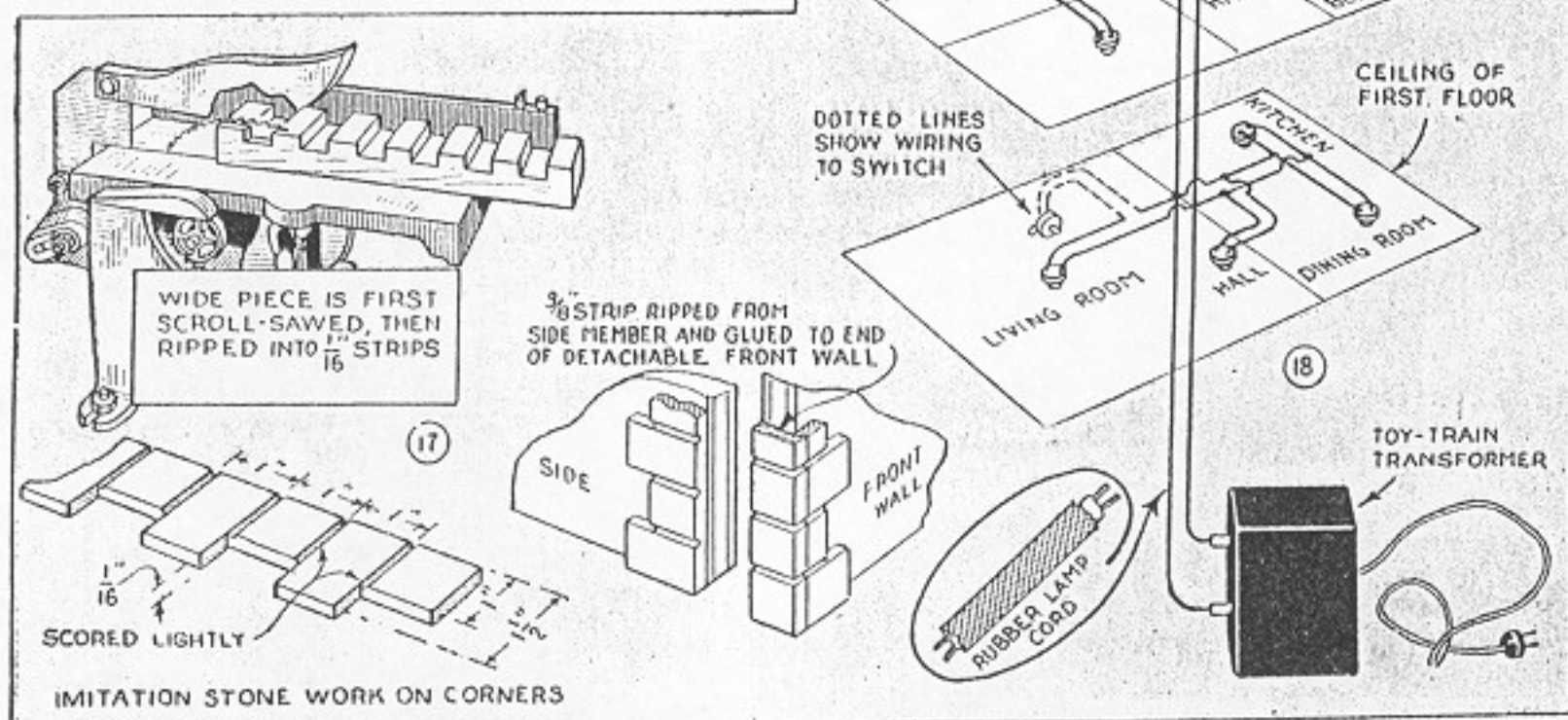
cleats secured to the house walls. The doorways between rooms are fitted with frames or trim, as in Fig. 14, and a neat baseboard is also installed in each room. The front door is hinged and swings inward in the standard arrangement, and is fitted with an all-wood latch operated from either side of the door, Figs. 2 and 10. The front of the door, which is plywood, is decorated with thin strips laid in the pattern of the squared diagram. A mahogany sill adds much to the realistic effect. In making the lock, see that all parts are loose enough so that the addition of paint will not cause them

to bind. A substantial balcony over the door is simply made as in Fig. 9, and has a very pleasing effect. It is a curved base with handrail and iron spindles. The rail and corresponding piece at the base are scroll-sawed and clamped together for drilling. This work is done with the pieces reversed, that is, the upper rail on the bottom so that it can be drilled only half-way through. Thus no holes are exposed when the rail is in place. A molded edge to the balcony base adds to its appearance.

Painting: The original doll house is finished to resemble stucco, and this is achieved by painting with a mixture of shellac and dry plaster, Fig. 15. When the mixture has hardened, it is gone over with



paint of whatever color you select. In this case, cream. The corner blocks are French gray; the roof green. Interior woodwork is white, with all walls papered. The paper was taken from a sample book, which cost nothing. For paste, a mixture of flour and water and a little alum was used. Window casements and balcony are white, with the spindles of the latter black. Floors are shellacked in natural wood, with oilcloth on the kitchen to resemble linoleum. If desired, electric lights can be installed as in Fig. 18, using a toy-train transformer and small, rubber-insulated wire. Tiny lamps and sockets for model-railroad installations are used in wiring the house.

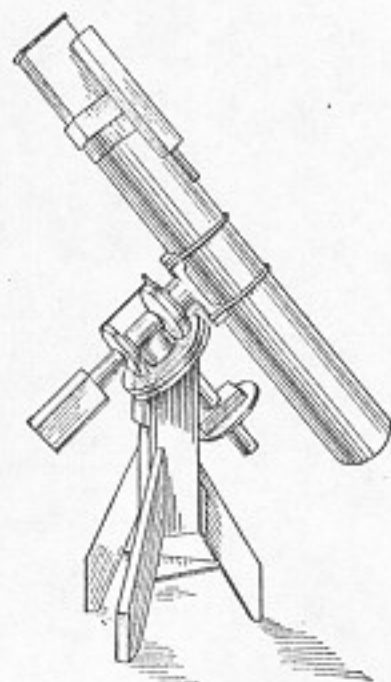


Boy Mechanic, 1913

How to Make a Telescope

With a telescope like the one here described, made with his own hands, a farmer boy not many years ago discovered a comet which had escaped the watchful eyes of many astronomers.

First, get two pieces of plate glass, 6 in. square and 1 in. thick, and break the corners off to make them round, grinding the rough edges on a grindstone. Use a barrel to work on, and



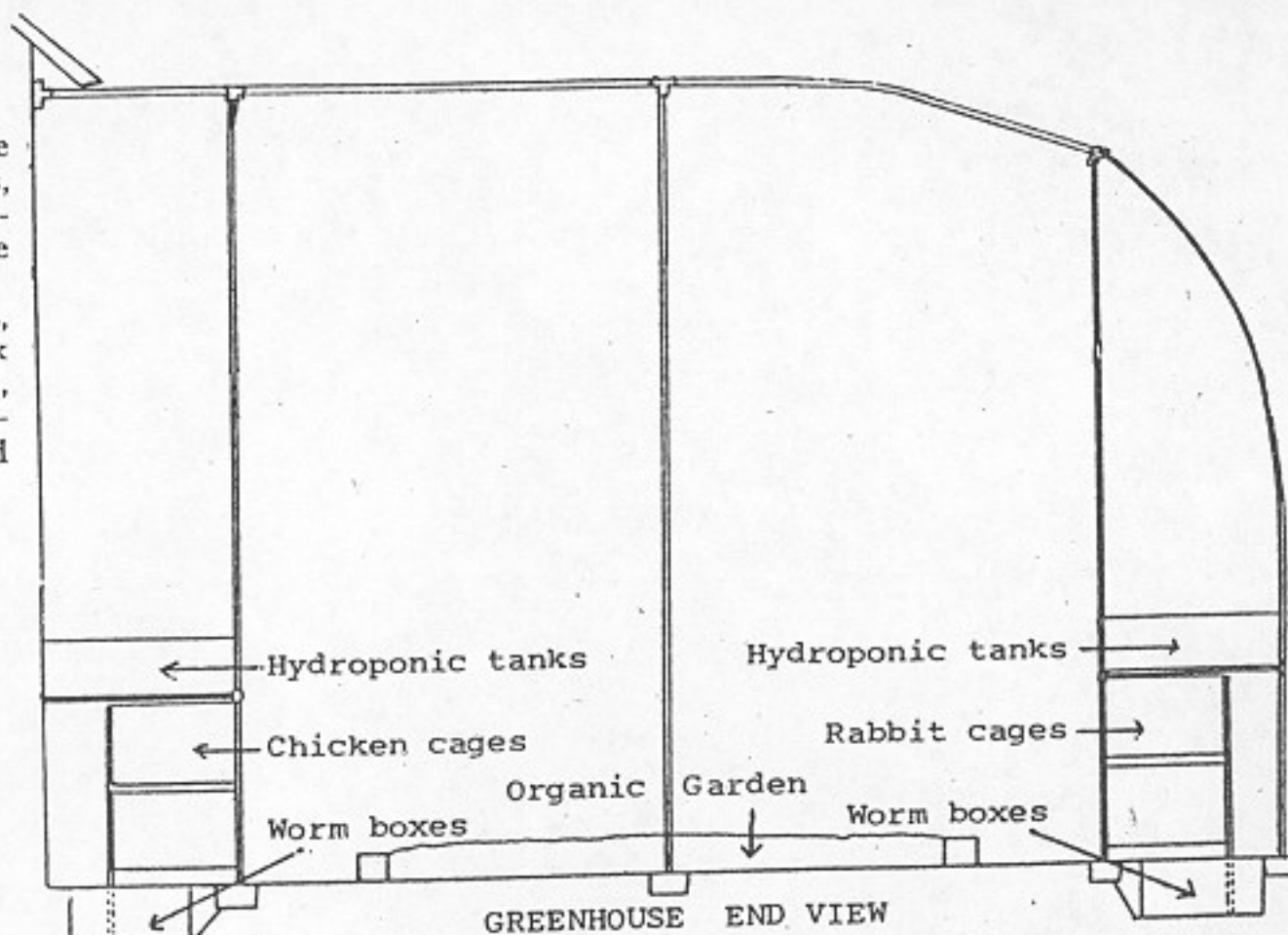
Homemade Telescope

fasten one glass on the top of it in the center by driving three small nails at the sides to hold it in place. Fasten, with pitch, a round 4-in. block of wood in the center on one side of the other glass to serve as a handle.

Use wet grain emery for coarse grinding. Take a pinch and spread it evenly on the glass which is on the barrel, then take the glass with the handle and move it back and forth across the lower glass, while walking around the barrel; also rotate the glass, which is necessary to make it grind evenly. The upper glass or speculum always becomes concave, and the under glass or tool convex.

Work with straight strokes 5 or 6 in. in length; after working 5 hours hold the speculum in the sunshine and throw the rays of the sun onto a paper; where the rays come to a point gives the focal length. If the glass is not ground enough to bring the rays to a point within 5 ft., the coarse grinding must be continued, unless a longer focal length is wanted.

Have ready six large dishes, then take 2 lb. flour emery and mix in 12 qt. of water; immediately turn the water into a clean dish and let settle 30 seconds; then turn it into another dish and let settle 2 minutes, then 8 minutes, 30 minutes and 90 minutes,



THE IDIOCY OF SPACE CAPSULE SURVIVALISM

By Kurt Saxon

I guess you've seen the ads for freeze-dried foods. Many show a young man, a woman, a couple of kids and usually a dog. A couple of semi-automatic rifles are in evidence; a Coleman lantern and all the paraphernalia of a ready-to-batten-down fall-out shelter. You are supposed to believe these nerds are going to go into something like a state of suspended animation while the rest of the world dies miserably.

Sure, they have a generator for light and VHS. But if you examine such ads, you'll notice there is virtually nothing to do. Just breath in and out. Eat Mountain House Freeze Dried Foods, drink canned water, use a chemical toilet and wait and wait and wait. But wait for what? Until their betters put the world back together again?

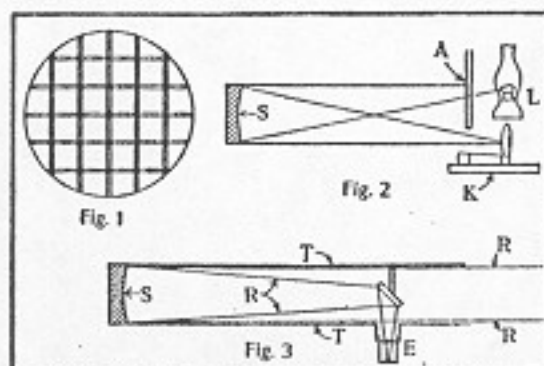
I've seen this attitude in so many people who claim to be survivalists that I think it's about time to put survivalism in its proper perspective. First, survivalism is not a business catering to the anxieties of neurotics. From the ads you see in so-called survival-oriented publications you might get the impression that all the paranoids and nervous Nellys are lining up to be fleeced by gloom-and-doom con-artists. Such publications feature various ads for the complete equipping of your own underground nuthouse.

What most people don't realize is that if you

being careful not to turn off the coarser emery which has settled. When dry, turn the emery from the 5 jars into 5 separate bottles, and label. Then take a little of the coarsest powder, wetting it to the consistency of cream, and spread on the glass, work as before (using short straight strokes $1\frac{1}{2}$ or 2 in.) until the holes in the glass left by the grain emery are ground out; next use the finer grades until the pits left by each coarser grade are ground out. When the two last grades are used shorten the strokes to less than 2 in. When done the glass should be semi-transparent, and is ready for polishing.

When polishing the speculum, paste a strip of paper $1\frac{1}{3}$ in. wide around the convex glass or tool, melt 1 lb. of pitch and turn on to it and press with the wet speculum. Mold the pitch while hot into squares of 1 in., with $\frac{1}{4}$ -in. spaces, as in Fig. 1. Then warm and press again with the speculum, being careful to have all the squares touch the speculum, or it will not polish evenly. Trim the paper from the edge with a sharp knife, and paint the squares separately with jeweler's rouge, wet till soft like paint. Use a binger to spread it on with. Work the speculum over the tool the same as when grinding, using straight strokes 2 in. or less.

When the glass is polished enough to reflect some light, it should be tested with the knife-edge test. In a dark room, set the speculum against the wall, and a large lamp, L, Fig. 2, twice the focal length away. Place a large sheet of pasteboard, A, Fig. 2, with a small needle hole opposite the blaze, by the side of the lamp, so the light



Detail of Telescope Construction

from the blaze will shine onto the glass. Place the speculum S, Fig. 2, so the rays from the needle hole will be thrown to the left side of the lamp (facing the speculum), with the knife mounted in a block of wood and edge-ways to the lamp, as in K, Fig. 2. The knife should not be more than 6 in. from the lamp. Now move the knife across the rays from left to right, and look at the speculum with the eye on the right side of the blade. When the

need a fallout shelter, you're doomed, anyway. The bulk of solid fallout will fall from thirty to forty miles downwind of Ground-Zero. Residual fallout may cover hundreds of square miles further downwind, polluting grass, and consequently, the livestock who eat it, as demonstrated by Chernobyl. Even smaller particles will rise to the stratosphere and you may get cancer in twenty years.

Even so, our species will recover, with little incidence of mutation, as shown by Hiroshima and Nagasaki.

But most of those who've gone underground will die. First, those in the suburbs downwind from Ground-Zero will emerge to radiation and/or pestilence. Second, those in upwind suburbs will have to contend with irate neighbors. A neighbor locked out of your shelter will stop up your vents with malice aforethought. If you do live to emerge after a couple of weeks or a month, crazed survivors will tear you apart. At best, you will just be another refugee.

But say there is no war. What with the global population bomb ticking inexorably, it's only a matter of time, and not much time at that.

WORLD POPULATION	1850	-	1 billion
	1930	-	2 billion
	1975	-	4 billion
	1988	-	5 billion

(Read Paul Ehrlich's "The Population Bomb").

Our present burgeoning population is pushing 6 billion. With our waste products translated into pollution we have a potential Love Canal in and around every city and town, smog, and of course, the Greenhouse Effect. The Greenhouse Effect is already changing the world's weather patterns. It and other human waste, chemical, garbage, sewage, etc., will grow, along with the population. Soon, the air will not be fit to breathe, most outside vegetation will not be fit to eat and most water will not be fit to drink. Our species has simply outbred the carrying capacity of our environment and our socio-economic systems.

So it's only a matter of time, and a short time at that, until there will be a horrendous culling of Earth's homosapiens. This will happen even without a nuclear war. Since Chernobyl, with its massive radioactive pollution of entire countries has happily shaken the confidence of a lot of leaders that a nuclear war is both survivable and liveable. The destruction would be so massive, even indirectly, there would be no winners and no government; no socio-economic system would survive.

So there may not be a nuclear war after all. So civilizations may not go out with a bang but a whimper. And a stench and a wracking cough, I might add.

So what happens to the space capsule survivalists, then? As the system deteriorates, battening

focus is found, if the speculum is ground and polished evenly it will darken evenly over the surface as the knife shuts off the light from the needle hole. If not, the speculum will show some dark rings, or hills. If the glass seems to have a deep hollow in the center, shorter strokes should be used in polishing; if a hill in the center, longer strokes. The polishing and testing done, the speculum is ready to be silvered. Two glass or earthenware dishes, large enough to hold the speculum and 2 in. deep, must be procured. With pitch, cement a strip of board 8 in. long to the back of the speculum, and lay the speculum face down in one of the dishes; fill the dish with distilled water, and clean the face of the speculum with nitric acid, until the water will stick to it in an unbroken film.

The recipe for silvering the speculum is:

Solution A:	
Distilled water	4 oz.
Silver nitrate	100 gr.
Solution B:	
Distilled water	4 oz.
Caustic stick potash (pure by alcohol)	100 gr.
Solution C:	
Aqua Ammonia	
Solution D:	
Sugar loaf	810 gr.
Nitric acid	39 gr.
Alcohol (pure)	25 gr.

Mix solution D and make up to 25 fluid oz. with distilled water, pour into a bottle and carefully put away in a safe place for future use, as it works better when old.

Now take solution A and set aside in a small bottle one-tenth of it, and pour the rest into the empty dish; add the ammonia solution drop by drop; a dark brown precipitate will form and subside; stop adding ammonia solution as soon as the bath clears. Then add solution B, then ammonia until bath is clear. Now add enough of the solution A, that was set aside, to bring the bath to a warm saffron color without destroying its transparency. Then add 1 oz. of solution D and stir until bath grows dark. Place the speculum, face down, in the bath and leave until the silver rises, then raise the speculum and rinse with distilled water. The small flat mirror may be silvered the same way. When dry, the silver film may be polished with a piece of chamois skin, touched with rouge, the polishing being accomplished by means of a light spiral stroke.

Fig. 3 shows the position of the glasses in the tube, also how the rays R from a star are thrown to the eyepiece E in the side of the tube. Make the tube I of sheet iron, cover with paper and cloth, then paint to make a non-conductor of heat or cold. Make the mounting of good seasoned lumber.

Thus an excellent 6-in. telescope can be made at home, with an outlay of only

down won't do much good. Urban and suburban areas will be unliveable. Riotous looters will trash every home regardless of how many are shot during the death dance of the urbanites.

But say you have sense enough to realize that our more populous areas will become death traps. So you have a bugout vehicle all ready, especially in the event of a Red Alert. You may have a closet full of "survival gear" ready to unload into your cabover camper. Would you also have enough dangerously-stored gasoline to get you to your destination? Don't expect to buy gas on the road. And don't even expect to get far unless your vehicle can drive around all the stalled and/or wrecked vehicles and maneuver well off the road.

Aside from the shelter stupids and the bugouters, there are the hosts of overgrown Boy Scouts aping the military. In the event of a Russian invasion, the last thing we need is a bunch of infantile, fantasizing, camo-clad pseudo soldiers.

But the survival hucksters continue their barrage of ads for outfitting even more Purdys (the jerk who gunned down the kids in Stockton). They have so glamorized all of the tinny, junky, ammo-wasteful semi-automatics to the point where our citizens are becoming less well-armed.

The only guns you need are the basic and the practical. This would be a .38 revolver for the bedroom, a shotgun for close action and a bolt-action, 4 power scope-mounted 30-06 for reaching out. All these can be bought cheaply at a pawn shop. If they're in good condition when you buy them and you go to a range and practice using them your efficiency as a militiaman will make you a genuine asset to any defense force.

I feel strongly about this as I'm really turned off at gun shows by camo-clad adolescents skulking around trying to look fierce. This type usually wears a T-shirt saying "Kill 'em all, let God sort 'em out". Our military personnel should be honored, not lampooned.

As far as military equipment is concerned, I don't see a place for it in your survival preparations. Genuine military surplus clothing is good because it's sturdy and relatively cheap. If you must have it, patronize your local surplus store or gun show where you can try it on and examine it to make sure it's real military surplus.

The most objectionable kind preying on survivalists are mail order military outfitters. Looking through one of their numerous catalogues would be comic if it weren't such a ripoff of adolescents fantacizing manhood.

The first thing that struck me when I got a mailbox full of them was the outrageous prices for even the totally unnessesary. One item was a "Reference Book Safe" for \$39.95! It was a dictionary with its pages cut out about an inch from the

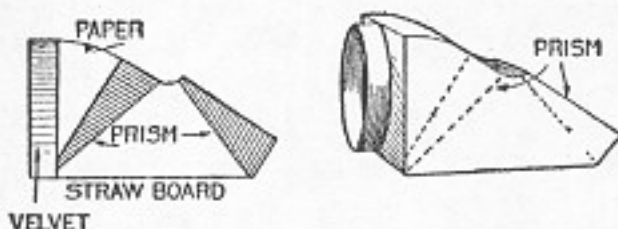
a few dollars. My telescope is 64 in. long and cost me just \$15, but I used all my spare time in one winter in making it. I first began studying the heavens through a spyglass, but an instrument such as I desired would cost \$200—more than I could afford. Then I made the one described, with which I discovered a new comet not before observed by astronomers.—John E. Mellish.

How to Make "Freak" Photographs

The "freak" pictures of well-known people which were used by some daily newspapers recently made everybody wonder how the distorted photographs were made. A writer in Camera Craft gives the secret, which proves to be easy of execution. The distortion is accomplished by the use of prisms, as follows: Secure from an



optician or leaded-glass establishment, two glass prisms, slightly wider than the lens mount. The flatter they are the less they will distort. About 20 deg. is a satisfactory angle. Secure them as shown by the sectional sketch, using strawboard and black paper. Then make a ring to fit over the lens mount and connect it with the prisms in such a way as to exclude all light from the camera except that which passes through the face of the prisms. The inner surface of this hood must be



Arrangement of Prisms

dull black. The paper which comes around plates answers nicely. If the ring which slips over the lens mount is lined with black velvet, it will exclude all light and hold firmly to the mount. Place over lens, stop down well after focusing, and proceed as for any picture.

How to Mix Plaster of Paris

For the mixing of plaster of Paris for any purpose, add the plaster gradually to the water, instead of the contrary, says the Master Painter. Do not stir it, just sprinkle it in until you have a creamy mass without lumps. Equal parts of plaster and water is approximately the correct proportion. The addition of a little vinegar or glue

sides, forming a hollow for valuables. Rather than a dictionary which a guest might reach for, it should be an obscure kind of book no one would refer to. Anyone could duplicate such a safe in a few minutes with a razor knife. I can't imagine anyone so stupid as to buy such a joke, and for \$39.95, at that.

If you are so immature as to feel the need to buy military or camping equipment for emergencies, go first to your local surplus store or to Sears or Wards. You'd be surprised at the wide selection of the same or equal quality goods as are in those catalogues, and for much lower prices. This also goes for the "survival" catalogues. A good hardware or discount store has all you will need in the survival line. So patronize your local stores and save money on what you can examine first-hand, plus the savings in postage.

If you're aware of the crisis approaching our planet, save your money and don't be influenced by anyone preying on your fears. You can't buy survival. Don't be played for a sucker.

What you're going to need to survive is a location about a hundred miles from any sizeable city. War or no war, temporary survivors will spread out like locusts. Best to be in a small town out of their range.

Thus, you'll need a house, preferably with about a half acre, a basement and within the town limits. The basement is a necessity in case of a nuclear war. A followup on Chernobyl pointed out that the radiation outside was 40 times that within a structure. A basement would be that much more protective.

Another thing about buying is that, aside from a fire extinguisher, medications and a generator, you should never buy for emergencies.

By its very nature, an emergency is something not anticipated. We don't really know what will happen in the next couple of years. Maybe nothing. So you shouldn't loot your bank account for a lot of things you won't need soon. But in light of what might happen, here's a rule of thumb:

Consider what you have, what you use all the time and simply buy more. Now, in anticipation of hard times, adapt your present life style to a more conservative one. Stop buying what you will have to process later. Don't buy bread. Buy grains, grind them and bake your own bread. Don't buy milk by the gallon. Buy it by the large box, dried and storable and learn to use it. It's ever so much cheaper and just as good.

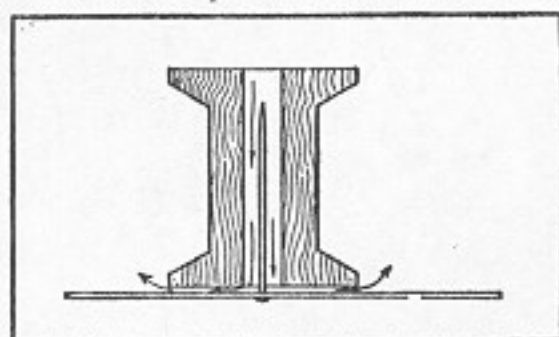
Whenever tempted to buy processed foods, think. Can you process them yourself, cheaper and with simple ingredients? Then do it!

Buy tools, not to store away but to learn to use, now. Consider the accompanying doll house article. Buy tools and whatever else you'd need to

water will retard the setting of the plaster, but will not preserve its hardening. Marshmallow powder also retards the setting. In this way the plaster may be handled a long time without getting hard. If you wish the plaster to set extra hard, then add a little sulphate of potash, or powdered alum.

A Curious Compressed-Air Phenomenon

Push a pin through an ordinary business card and place the card against one end of a spool with the pin inside the bore, as shown in the sketch. Then blow through the spool, and it will be found that the card will not be blown away, but will remain suspended without any visible support. This phenomenon is explained by the fact that the air radiates from the center at a velocity which is nearly constant, thereby producing a partial vacuum between the spool and the card. Can

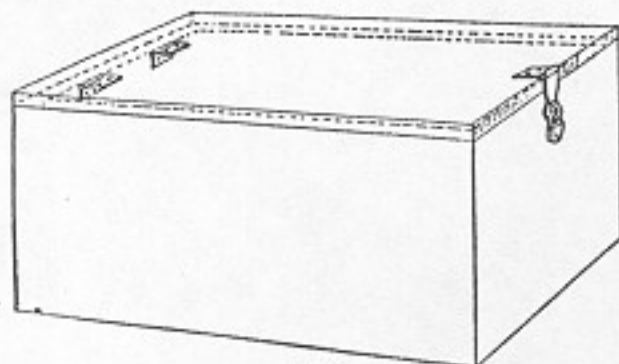


Experiment with Spool and Card

the reader devise a practical application of this contrivance?

Magic-Box Escape

The things required to make this trick are a heavy packing box with cover, one pair of special hinges, one or two hasps for as many padlocks and a small buttonhook, says the Sphinx. The hinges must be the kind for attaching inside of the box. If ordinary butts are used, the cover of the box



Box with Hinges and Lock

must be cut as much short as the thickness of the end board. The hinges should have pins that will slip easily through the parts.

build one. I guarantee you'd sell it for about \$300.00. But, more important, you'd gain valuable skills for an uncertain future.

Food is a big item. Learn sprouting. Better, duplicate the greenhouse. Read "You Can Survive The Nuclear Winter", pages 266-273 of THE SURVIVOR Vol. 1. Modify that greenhouse to occupy the whole sunny side of your house. Have a side door from your house leading to it. Instead of two sides, as illustrated in the first edition, have but one side and tuck the top of the other side under the eaves of that side of the house. The greenhouse will grow fallout-free vegetables.

Maybe you know nothing about growing things. Learn. Start out by raising African violets or something else commercial to pay for that greenhouse. As you learn, you'll understand hydroponics (THE SURVIVOR, Vol. 2, pages 594-650). Such a greenhouse would quickly pay for itself even by saved energy costs. It would shade your house from the worst summer heat on that side and so save on air conditioning costs. In the winter it would collect heat from the sun and heat the sunny side, thus saving heating bills.

Being a food producer your greenhouse would be an asset to the neighbors. They would even protect you from potential looters.

Don't make "survival" purchases yet. First invest in knowledge. Buy all my books, of course. Also, a complete set of back issues of THE MOTHER EARTH NEWS would be a treasure. Get a set of THE FOXFIRE BOOKS. Also, scrounge second-hand book stores for back issues of ORGANIC GARDENING AND FARMING. All these are not only valuable but interesting. Don't forget books on greenhouses.

So don't be a nerd with the suicidal space-capsule survivalist mentality. Become what you'll need to be. I don't think you'll have a chance of surviving unless you make yourself worthy of survival. This means not only learning self-sufficiency but having something to pass on to the next generation.

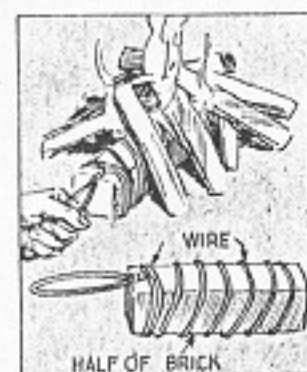
Before entering the box the performer conceals the buttonhook on his person, and as soon as the cover is closed and locked, and the box placed in a cabinet or behind a screen, he pushes the pin or bolt of the hinge out far enough to engage the knob end with the buttonhook which is used to pull the pin from the hinge. Both hinges are treated in this manner and the cover pushed up, allowing the performer to get out and unlock the padlocks with a duplicate key. The bolts are replaced in the hinges, the box relocked and the performer steps out in view.

POPULAR MECHANICS

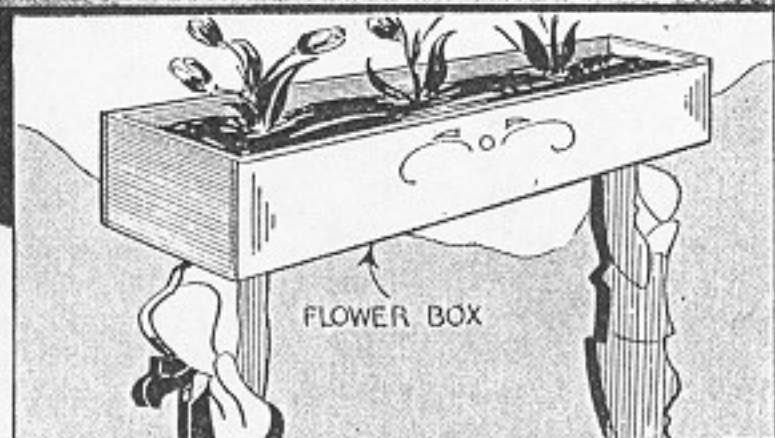
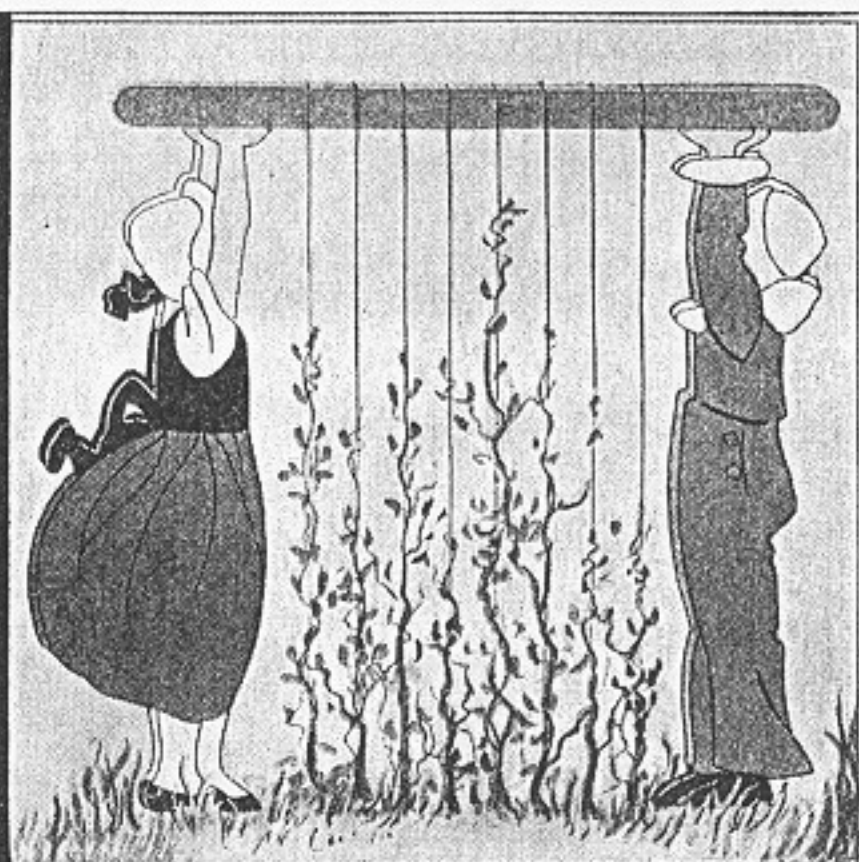
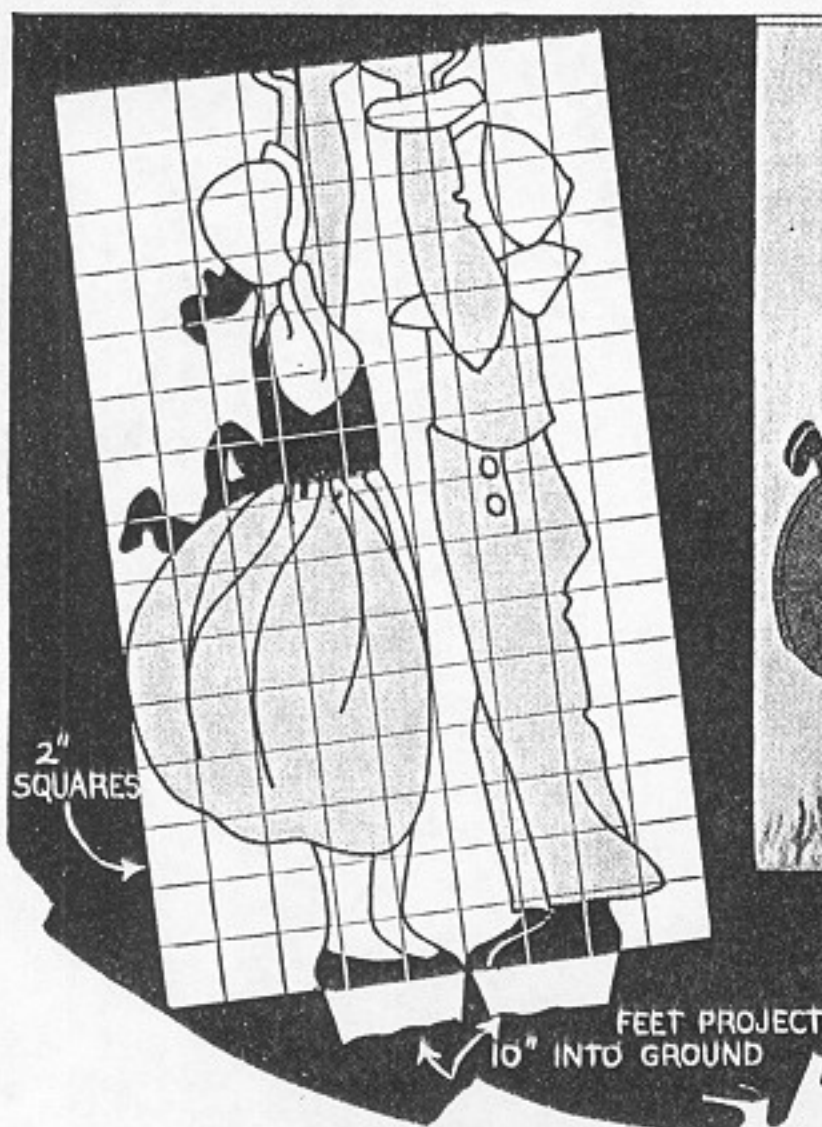
March, 1939

Brick Soaked in Kerosene Kindles Fire

You'll have no trouble starting a fire at camp, in a stove or in your fireplace, if a soft brick soaked in kerosene is used. It's best to split the brick in half and wrap it with heavy wire to provide a handle.



Gay Supports for Trellises and Flower Boxes



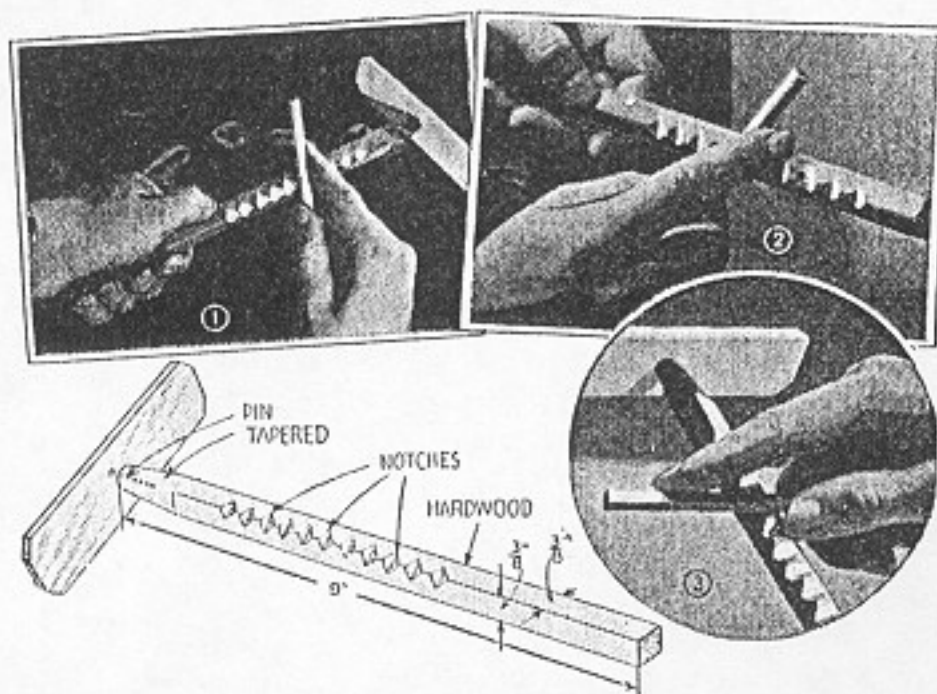
Painted to resemble folk costumes, these wooden cutouts make pleasing decorations in your garden. They may be used to support a bar with cords for vines, a flower box or a trellis. If the figures are to stand on the ground, the wood should project below the feet about 10 in. It is best to fasten them to wood or angle-iron stakes

driven deeply into the ground. The appearance is pleasing with the girl costumed in black, red and white and the boy in a blue with white trim.

Popular Mechanics June, 1939

Magic Pinwheel Changes Rotation at Command of Voice

You can have fun mystifying your friends with this trick pinwheel, which changes direction of rotation at a spoken command. The secret of making it spin is in the way the handle is rubbed. Grip the handle and rubbing stick as in Fig. 1 and, with a forward and backward movement, rub the stick over the notches, allowing the index finger to slide along one side as in Fig. 2. To reverse the direction, continue rubbing but lift the index finger as in Fig. 3, and let the end of the thumb nail rub against the opposite side.





Science And Invention November, 1930

Mystic Fish Story

A LARGE transparent glass canister filled nearly to its brim with nothing but water is covered by a borrowed handkerchief. After a few moments, the handkerchief is removed, when to the amazement of the spectators a dozen or more goldfish are found to be swimming about in the water. The secret lies in the fact that the canister is divided by a piece of glass mirror. The reflecting side is toward the audience. The fish are concealed behind the partition. When the handkerchief is removed, the glass is withdrawn and disposed of by being left on the table top while attention is called to the fish.

A Fortune in Eggs

A TRAY of eggs, all unprepared, is passed for inspection. The magician then removes a pencil from his pocket, cracks the egg with it, and then withdraws a twenty dollar bill from the interior of the egg. The trick requires a little preparation. A clutch pencil is fitted with a spring that pushes a rolled bill out of the hollow top. A bayonet catch secured to the piston holds the spring in place until, at the opportune moment, it is released and a rolled bill is forced into the interior of the cracked egg. An unprepared

By

Hummer

The master mind of modern mystery, who has mystified Ex-Presidents Harding, Taft, Roosevelt, Coolidge, the Prince of Wales and other celebrities



The double bag permits of an ingenious blindfold cigarette test.

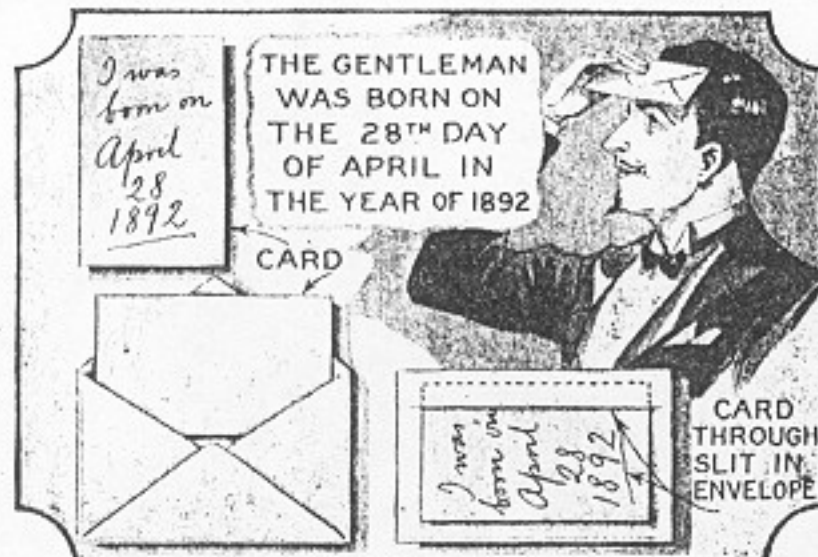
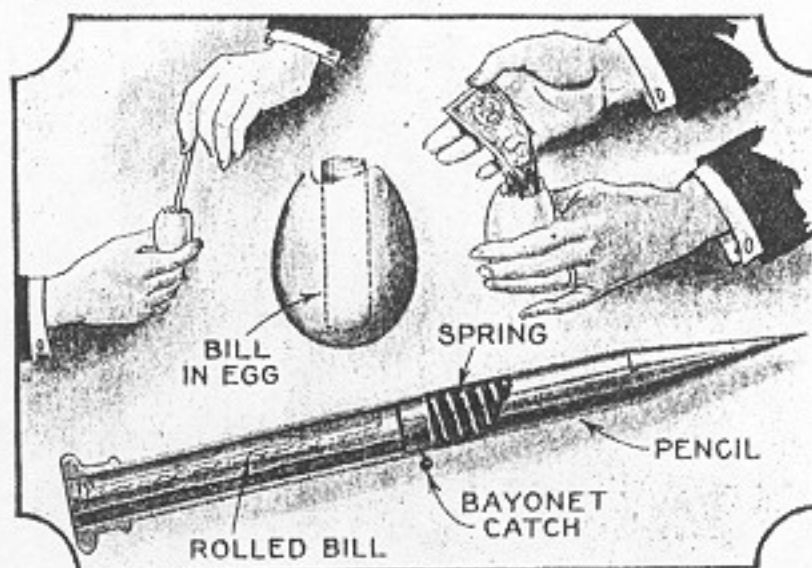
pencil similar to the one used for the effect should be available in case examination is requested.

Naming a Cigarette

THE magician asks the spectators to drop cigarettes into a bag, and he will demonstrate an ingenious blindfold test. The cigarettes are called aloud as they are accumulated, Camels, Chesterfields, Old Golds, Pall Malls, Fatimas, Murads, Melachrinos, and many of the other brands that will be found in a well packed house. The magician is now securely blindfolded, and a spectator is asked to pick out any cigarette from the bag, light it and blow a puff of smoke in the direction of the magician, who may be standing eight or ten feet away. The magician correctly names the brand. The secret lies in the fact that the bag is double. On one side of the partition ten or twelve Old Gold cigarettes are secreted. The spectators drop their cigarettes in the opposite side of the bag, but the one which is chosen comes from the first mentioned side and must, of course, be one of the cigarettes previously placed therein by the performer.

Second Sight

THE magician requests that the spectator take one of his own visiting cards and write a date, number or name upon it, while the magician walks away. This card is then taken from the spec-



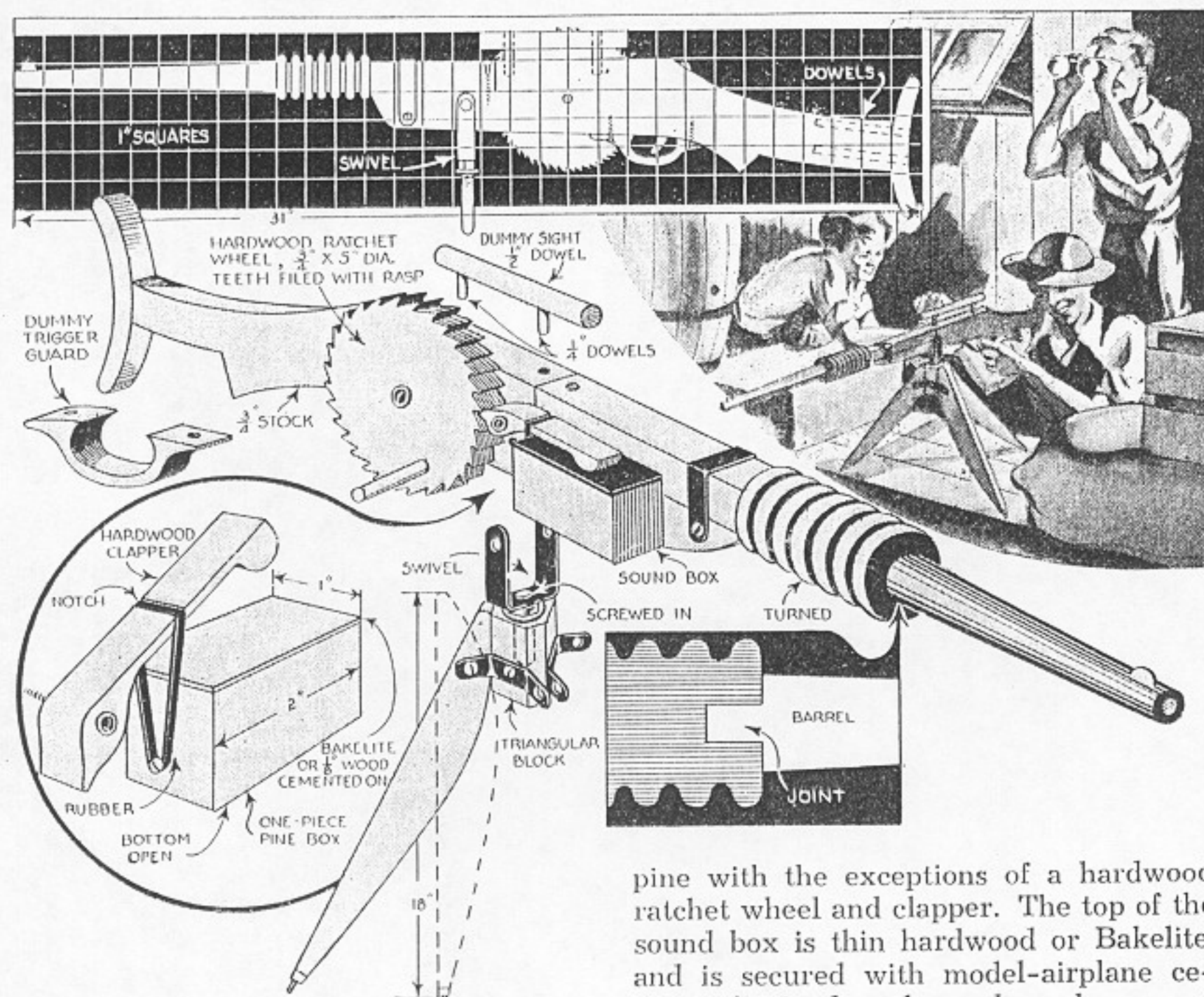
tator, and held with the writing toward the floor. It is then pushed into an envelope, the envelope sealed, and then held to the forehead of the magician, who correctly divines its contents. The

envelope is torn open and the card returned to the spectators. The effect is carried out by slitting the envelope with a razor blade and in the act of pushing the card into it, permitting the card to

pass out through the slit, as the envelope is held to the forehead, the message is read. Tearing the envelope to get at the card destroys the evidence.

Popular Mechanics September, 1939

Play Machine Gun Stutters Challenge to Foe



Boys will have a lot of fun staging sham battles with this machine gun, which is harmless as it uses no ammunition but produces a realistic sound. It is made of

pine with the exceptions of a hardwood ratchet wheel and clapper. The top of the sound box is thin hardwood or Bakelite, and is secured with model-airplane cement. A tripod can be made as shown, and adds much to the "front-line" effect. The outfit can be dismantled instantly and carried over no-man's land each time the battle line advances.

The Scientific American 1861

Distilling Coal—Manufacturing Gas.

Three patents have lately been taken out in England, very original in their character and apparently important in their adaptation to distilling cannel coal for obtaining gas. Two of these patents have been obtained by Mr. J. Leslie, of which the following is the substance:—

First, heretofore, in manufacturing gas from coal

and other bituminous mineral substances, it has been usual to subject them to the process of destructive distillation, and then purify the gas. This improvement in the manufacture of gas from cannel coal and other mineral bituminous matters capable of affording paraffine, consist in subjecting such matters to distillation at low temperatures, in order to obtain the products distilled over in a condensed liquid form, then remove the ammonia, sulphur, and other impurities, and then subject the purified liquids to destructive distillation.

Mr. Leslie prefers to use a cylindrical retort heated

externally by a fire and made to revolve slowly. Into this the coal or bituminous mineral is introduced, broken up into small pieces, and the products evolved pass off to the condensing apparatus, which is constantly kept cool by water, while the condensed hydrocarbon products are received into a suitable receiver or vessel. Care is taken to keep down the heat of the retort, in order to prevent the production of gas or vapors which will not condense, the object being to obtain only fluid hydrocarbons by the first process of distillation. When using the better classes of cannel coal, the hydrocarbons obtained may at once be employed for the manufacture of gas, but when using hydrocarbons which have nitrogenous and sulphur compounds combined therewith, these are purified in the following manner.

To remove the nitrogen the crude hydrocarbons are washed with acid; dilute sulphuric acid will answer the purpose, but dilute muriatic acid is preferable, prepared by adding five gallons of water to one gallon of the concentrated muriatic acid of commerce; the hydrocarbons are then agitated violently with this diluted acid, using 15 gallons of the diluted acid to every tun of the oil. The mixed hydrocarbons and acid are then allowed to stand for twelve hours, at a temperature of 90° to 100° Fah., and then the layer of acid liquor which has separated is drawn off. To free the hydrocarbons from sulphur compounds, the patentee uses at the rate of 1 lb. caustic soda with one gallon of water, and from 14 to 30 gallons of such solution will be found sufficient to purify a tun of the hydrocarbon fluid. For this purpose the solution is well stirred into the hydrocarbons, and then allowed to settle for some hours, when the purified hydrocarbons may be readily drawn off from the impurities. In order to convert the hydrocarbon liquid or crude oil into illuminating gas, it is caused to drop into a retort or vessel heated to a good red heat, and the gas is conveyed from the retort into gasometers of the ordinary construction, from which the illuminating gas is supplied to the gas mains, as gas has heretofore been supplied from gasometers.

The second patent is chiefly for the purification of the gas. The gas is conducted from the retort into a chamber, which has a valve in it, instead of conducting it to the hydraulic main in the common way. In this chamber there is kept a pile of wood shavings saturated with a solution of the sulphate of copper. The gas, in passing through this, has all its impurities removed.

The third patent is that of W. M. Williams, which is directly opposite in its nature, so far as it relates to the distillation of the coal, and yet both methods may be great improvements in making gas over the modes commonly practiced. It consists in distilling the coal first at a heat much higher than is now used, and at a very great pressure.

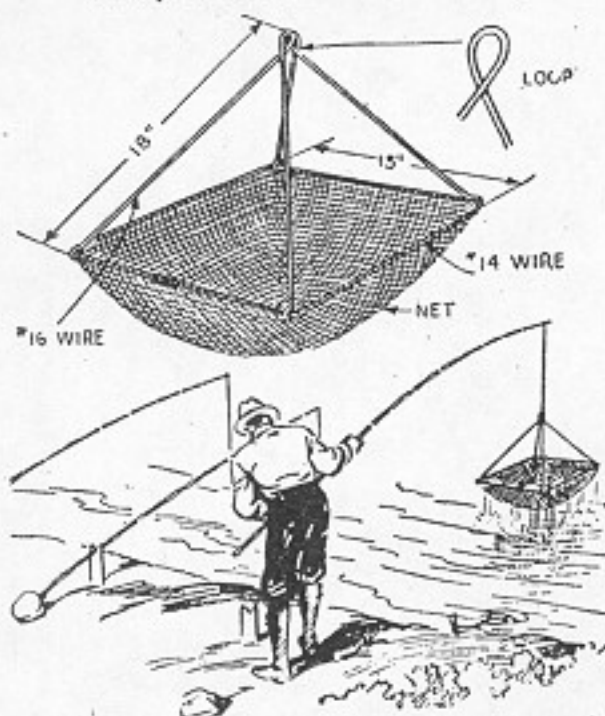
The patentee employs a distillatory apparatus, made of cast or wrought iron, and consisting essentially of two vessels connected by a pipe, one of which consti-

tutes a retort and the other a receiver. The retort is set in a furnace, and the receiver is immersed in water or otherwise kept cool. The retort has an opening, at which the material to be operated upon is introduced, and the residuum removed, and the receiver has an opening from which the products obtained are removed. Both the openings are provided with covers for closing them hermetically. At the receiver, is a safety valve, for permitting the escape of gaseous matter when the pressure in the interior of the apparatus reaches the required maximum. As soon as the retort is charged, all the openings in the distillatory apparatus are securely closed, excepting the safety valve, which is loaded to the greatest pressure to which it is wished to subject the contents of the retorts. The retort is then rapidly raised to, and maintained at, a red heat, until volatile products cease to pass off. The gaseous matter first produced accumulates in the apparatus, and by the pressure it exerts determines the formation of a larger proportion of solid and liquid hydrocarbons than is obtained under the pressure of the atmosphere only. The excess of permanent gas formed escapes at the safety valve. It is preferred to distill the coal or other bituminous mineral at a temperature higher than that which it would be desirable to employ if the distillation were conducted under atmospheric pressure only; the pressure being increased according as the temperature of the retorts is raised. The adjustment between the temperature and pressure is obtained by means of a small aperture formed by partially closing a stop-cock fixed on any convenient part of the distillatory apparatus. The stop-cock is closed so far, that the gas evolved at a full red heat from the coal shall not be able to escape through the stop-cock unless it passes out with the velocity acquired by a pressure equal to about twenty atmospheres, or three hundred pounds on the square inch. Any increase of temperature is attended by an increased evolution of gas, and a consequent increase of pressure, and any diminution of temperature is attended by a corresponding diminution in the production of gas, and the pressure becomes correspondingly diminished.

The subject of "gas light" is of very general interest, and any improvement whereby gas can be obtained at less cost to consumers should receive attention. The first patent of Mr. Leslie may almost be considered as the application of coal oil to the manufacture of gas. As the petroleum oil of Pennsylvania wells is very low in price at present, it may be economical to use it as a substitute for coal in making gas. The suggestion is worth a trial by some of our gas companies.

Popular Mechanics
September, 1939

Small Folding Crawfish Nets Easy to Store and Carry

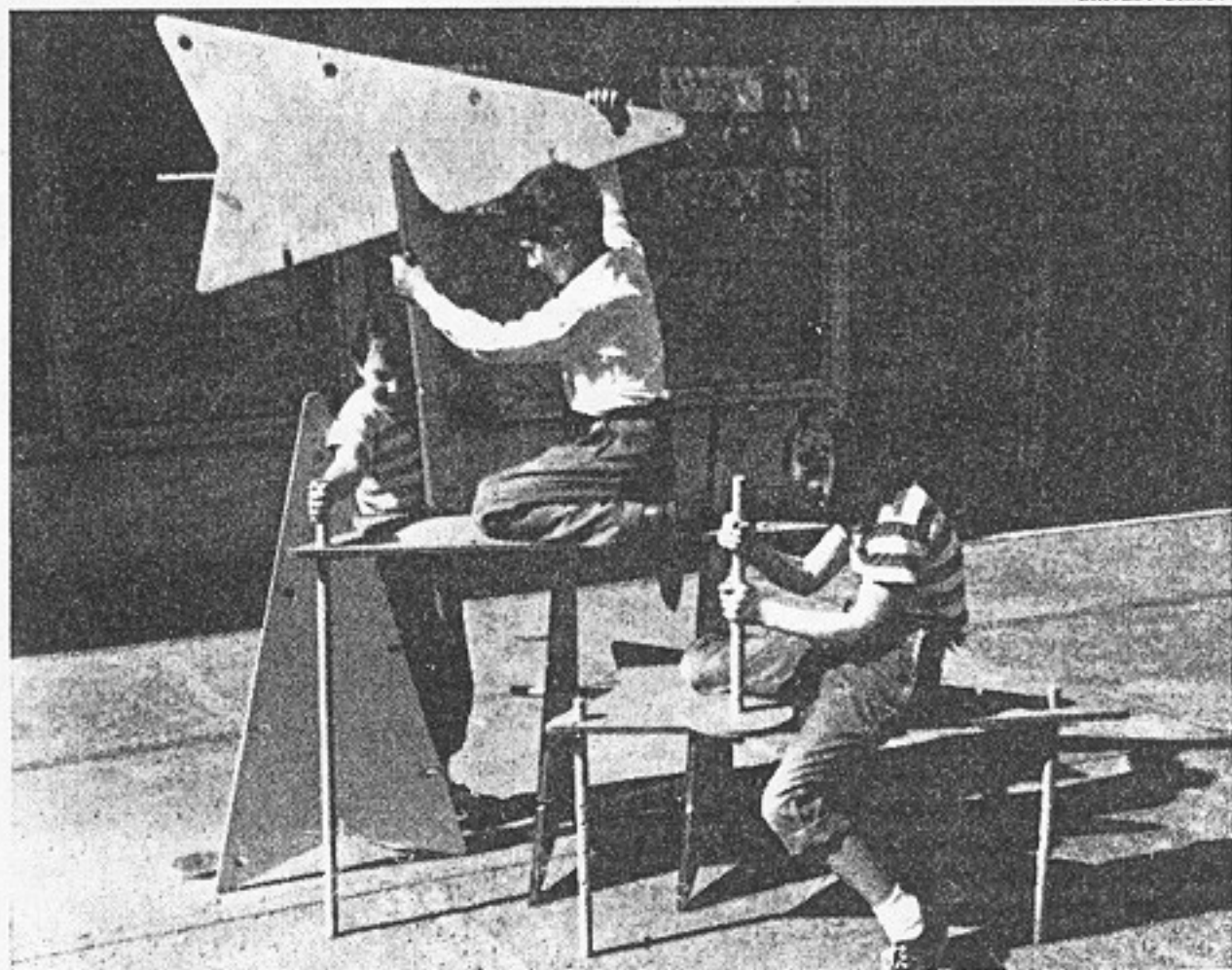


More crabs can be caught in a day with several small nets spaced some distance apart than in a single large net. Also, the little nets are easy to store and carry. Use No. 16-gauge galvanized iron wire and $\frac{1}{2}$ -in. mesh net to make a pocket 8 in. deep. Tie the bait in the center with twine. Always carry your crawfish or crabs home in a sack or basket, because if confined in still water they will die almost at once. In air they will live several days.

Chicken Is Held over a Barrel When Plucking Feathers



To hold fowls conveniently for plucking, one produce merchant uses a simple, detachable wire clip and hook which support the birds over an open barrel, in which the feathers drop. The clip is pushed between the barrel hoop and staves to engage the bird's feet, while the hook is attached to a rubber band anchored on the side of the barrel. The hook engages the neck and stretches the carcass across the opening. The hook and clip are made of heavy wire.



Fanciful building project resembles nothing that the children have ever seen before, or may ever build again. Platforms are excellent for launching interplanetary rockets

From one sheet of plywood . . .

A giant building toy

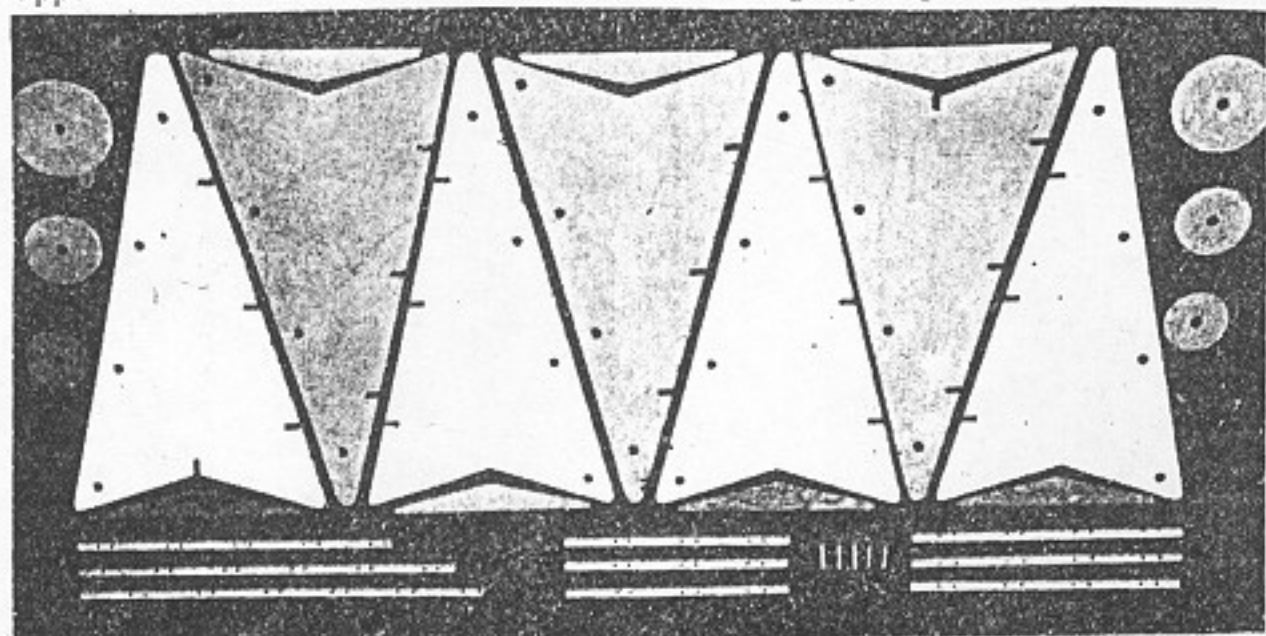
SUNSET August 1961

One sheet of $\frac{5}{8}$ -inch Douglas fir plywood can be cut into the 14 triangles and 6 wheels which are the basic parts of this giant building toy. As designed by Martin Metal and Associates of Sausalito, California, the parts can be joined easily by means of the overlapping slots, holes, dowels, and pegs.

Like the giant construction toy which appeared in the December 1952 *Sunset*,

this one furnishes the raw material for an endless variety of child-engineered construction projects—plain and fancy buildings, vehicles, ships, aircraft, furniture, store counters, and gymnastic equipment. The small triangles may also be carried as shields or worn as breastplates by some twentieth century knights.

To make the dowels fit more easily, ream holes slightly larger than sizes indicated,



Stock pile of all parts shows the triangles and wheels which were cut from a 4 by 8-foot sheet of plywood. One-inch dowels with $\frac{1}{4}$ -inch pegs laid out above

RAZOR BLADE RADIO

One common complaint I always hear from CB'ers is that they haven't had sufficient experience with electronic construction to build any projects. Or, they have had experience, but they don't own a junkbox or radio gear, from which to extract components for a new project.

To keep these people happy, I have dug back into my old kit bag and come up with a radio receiver which even the most inexperienced novice can complete--without solder, without know-how, and using only a handful of non-electronic pieces of scrap from around the house. Looking at the parts list you will see a razor blade, a piece of pencil lead (carbon), nails, thumb tacks, paper clips, etc. Does it work? Ask any ham who was a dogface in Korea or World War II. We used to build these things in fox holes and could get reliable reception for 25 miles or more, depending on the complexity of the antenna and ground system used. If you want to have some fun, plus building a real pioneering type piece of "electronic gear" at no expense, why not put together the RAZOR BLADE RADIO. It could be the first of a long series of electronic gadgets you will build (as it was for me).

CONSTRUCTION

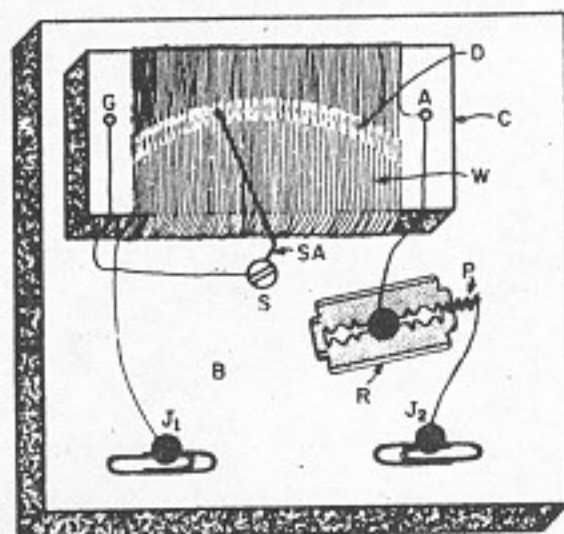
The schematic for our receiver is shown in Fig. 1. It will be recognized as that of a simple diode detector connected to a pair of headphones.

The actual design of the receiver is shown in Fig. 2. If you follow its simple layout you should have no trouble getting fired up in an hour or so.

The longest antenna possible and a cold water pipe ground should really pull 'em in. If a long antenna isn't possible, try hooking the antenna lead to the chrome finger-stop on a telephone dial.

The detector is the piece of pencil lead wrapped with copper wire, resting lightly on the razor blade. Some adjustment of the location and pressure of the pencil lead on the blade may be required. We always used a double edged blade, so we can't tell you if a single edge job will work.

RAZOR BLADE RADIO



PARTS LIST & INSTRUCTIONS

Fig. 2

PARTS LIST & INSTRUCTIONS

A--This is a nail which is used as the antenna terminal, and also for holding the coil form to

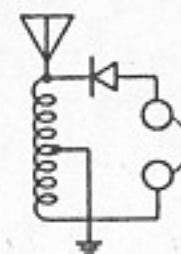


Fig. 1. Schematic of the Razor Blade Radio.

the baseboard.

B--The baseboard, a piece of wood (plywood or soft pine is OK) 1/4" thick, 4" square.

C--Coil form, 1/4" wood, 3 3/4" long, 2" wide.

D--Area of coil which will be touched by "SA," this should be scraped clean of insulation along the movement area at the tip of "SA."

G--This nail is used for the ground connection and to fasten the coil

form to the baseboard. It is also connected to "S."

J--Two copper paperclips which are used as jacks for the headphones. They are held in place by thumb tacks.

P--Pointed piece of pencil lead, wrapped with copper wire which is attached to J₂. The wire should be resilient enough to hold the lead in place on the blade (see text).

R--Razor blade held down by a thumb tack. Also attached to the tack is a wire which runs to the antenna terminal, "A".

S--Screw or nail which is used as the

pivot for "SA," the switch arm.

SA--The switch arm, which is made from an opened up paper clip. Moving "SA" back and forth along "D" will enable you to change stations. Tune slowly and adjust "P" as described in the text for maximum results.

W--Coil winding on "C." This is approximately 175 turns of #26 insulated wire. One side is connected to the antenna terminal, the other side is connected to J₁.

Misc.--Wire; pair of 1,000 to 2,000 ohm headphones.

So have fun. I hope that this little project will show you how simple it is to get started in electronic construction.



Merry-go-round swing designed by Dr. Julian P. Henry of Los Altos Hills, Calif.

Two tire swings

SUNSET AUGUST 1968

These two children's swings were made inexpensively for a nursery school from discarded tires.

The simpler one is the horizontal, wind-up version shown above, which is fun for three or four children at a time (they quickly find out how much spinning they can tolerate). It's hung on a conventional swing set frame by four nylon ropes tied to eye bolts inserted in the tire through 2 by 4 blocks of wood.

Below is the traditional cradle or bucket-type swing. To make it, use a sharp linoleum-type knife to cut through the tire, leaving the tire bead for hand-holds and for attaching to overhead chains.

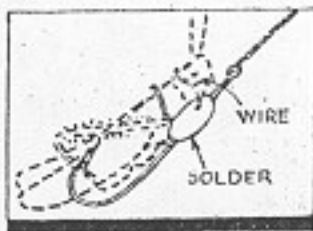


Cradle-type tire swing has been in use 16 years. This one was cut from a truck tire

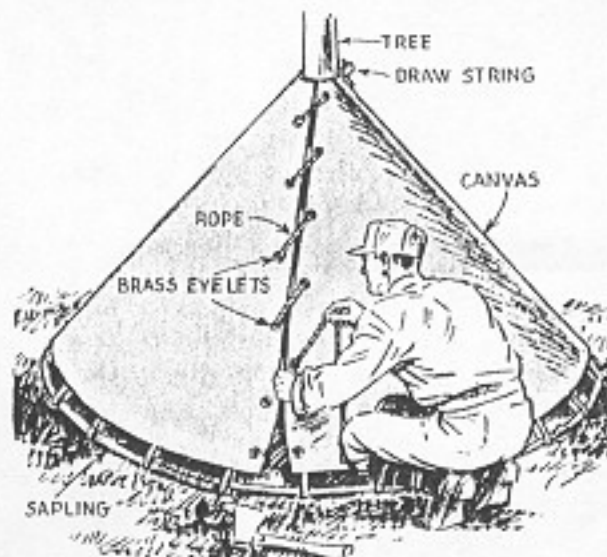
POPULAR MECHANICS 1939

Weighted Hook for Casting with Insect Bait

Fishermen who have difficulty in casting a hook baited with a grasshopper or other light insect will find that a solder-weighted hook overcomes the trouble. If a U-shaped piece of small wire is cast in the solder, the projecting ends will serve as a clamp which can be bent around the insect.



Hiker's Tepee Tent Folds into Light Bundle for Carrying

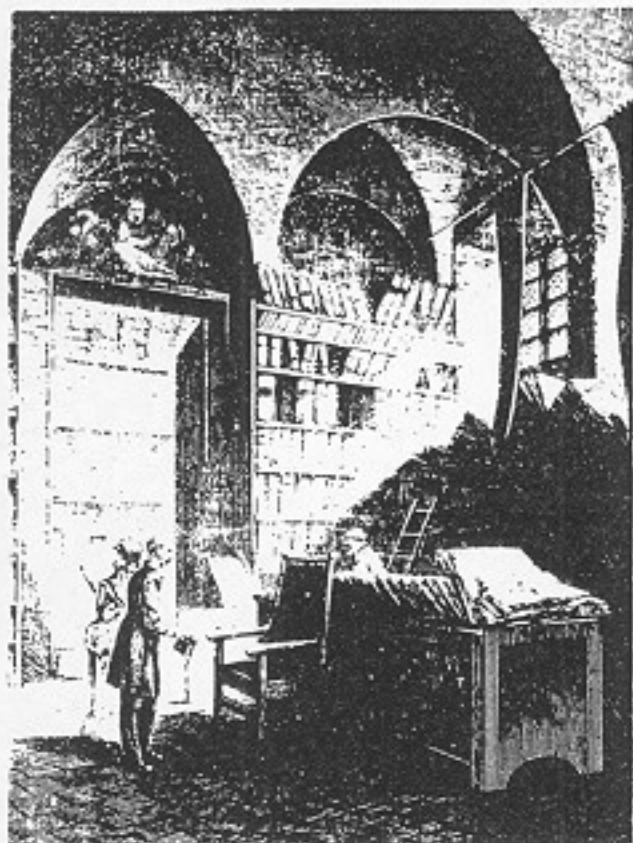


This novel tent was used several seasons by a woodsman. It is set up around a tree trunk, which serves as a center pole so that all the hiker carries is the canvas and the drawstring or top cord. The tent consists of several segments sewed together tepee fashion with a ground diameter of 10 ft. and a center hole that can be opened to 10 in. To keep the canvas taut, a number of small rope loops are sewed to the lower edge, through which small saplings are run and the ends lashed together.

POPULAR MECHANICS

July, 1939

From the Archives



Here is another selection from 19th Century Harper's Monthlies. They are various entries in the science sections which are thought provoking and sometimes clever. There might be an idea here, dropped back then, but worthy of reconsideration.

MINARGENT.

A valuable imitation of silver, called minargent, even exceeding silver in metallic lustre and in the maintenance of its white color, and bearing a very close resemblance to silver generally, is made by melting together one thousand parts of copper, seven hundred parts of nickel, fifty of pure tungsten, and ten of aluminium. The first three ingredients are to be melted together and then granulated by being poured into water; afterward dried and again melted, and the aluminium then introduced. At this stage of the process, however, one and a half parts of flux, consisting of equal parts of borax and of fluor spar, are to be added. The principal difficulty in the preparation of the alloy lies in the proper melting of the aluminium with so large a quantity of nickel, for which reason a flux is necessary.

ELECTRIZING WINES

Mr. Scoutellen, in a recent announcement, renews his assertion that a current of electricity passed through wines exercises a very positive influence in ameliorating and improving them, and refers the alteration to the decomposition of the tartrate of potassa by the electric current. The potassa set free neutralizes the acid of the wine, while the tartaric acid combines with its fatty matter, and tends to produce the ethers which furnish it bouquet. He also thinks that a certain portion of water is decomposed, disengaging the hydrogen at the negative pole and oxygen at the positive; and as oxygen, in a nascent state, possesses energetic properties, it produces new

RICHES IN RECYCLING

by Kurt Saxon

Billions of gallons of sewage poison our sea-coasts. Thousands of towns are being polluted by toxic chemicals. Smokestack emissions are contributing to the Greenhouse Effect, which will eventually destroy world civilization.

Yet, all this "pollution", recycled, would cut in half the cost of maintaining towns and cities, thus diverting \$billions to socio-economic advancement.

This article is not intended as a solution to present problems. There are no solutions. To verify this I'd like you to read "The Population Bomb" 1968, by Dr. Paul Ehrlich and "The Hunger To Come" 1965, by John Laffin. These books are out of print but your local library has them or can get them.

Both state that if a clearcut program to limit population growth and pollution is not implemented by 1980, there is no hope for the majority of our species. Nothing was done so now, even if all their suggestions were to be implemented, the end for most would still be inevitable.

You are not included among the doomed. So it will be up to you to implement the measures which will prevent a repetition of the mistakes bringing down our present civilization.

The technology, in part responsible for our decline, is firmly built in and has been for a century. Dismantling it, even if that could be done, would destroy our economy.

An example of the impossibility of reconversion is the steam-driven car as opposed to our internal combustion engine-driven cars. See "The Coming Age of Steam", SURVIVOR 1, page 46.

Modern steam prototypes are safe, quiet, non-polluting and cheaper to run. Yet there are hundreds of thousands of gas stations and millions of workers in them and the oil business, not to mention auto plants. A complete changeover from the major pollution cause to steam would be impossible.

Even a gradual change would be impossible. The modern steam car costs too much to build from the ground up. No industry could, or would, consider mass-producing such a vehicle as there would be no facilities for fueling and servicing them. So we will have to go back to square one before we can implement alternatives to the ruinous systems we already have.

But when the Greenhouse Effect, hunger, civil strife, insane weather, earthquakes, chemical pollution, etc., cull out the majority of Earth's population, rebuilding can begin. Then, with our science we can set up the cleaner, cheaper and ecologically sound systems.

The first priority after the collapse will be sanitation. Sewage disposal and water for drinking and washing will be number one. For this, the

compounds, which give character to the old wines, and tend to produce those qualities in the new that ordinarily require much time and care.

CHLORAL

Considerable attention has been directed in medical circles to the physiological action of a substance called chloral (or rather its hydrate), which was discovered by Liebig in 1832, and is produced by the action of chlorine upon alcohol. It is really a compound of chlorine, carbon, hydrogen, and oxygen, and is most readily prepared by distilling together starch or sugar, hydrochloric acid, and peroxyd of manganese.

When chloral is brought in contact with water it forms a white, crystalline, solid substance—hydrate of chloral; and this, when treated with an alkali, is decomposed into chloroform and a formate.

Theoretically, if hydrate of chloral be introduced into a living body, the alkali of the blood ought to liberate chloroform, and sleep as from chloroform would be expected to result, but probably for a longer time. Actual experiment has verified the theoretical suggestion; the chloroform thus liberated producing sleep precisely similar to the sleep of chloroform itself, and lasting at will for a number of hours. It is, however, at present considered a very uncertain and somewhat dangerous substance, and one that will probably not replace chloroform, especially as it has been ascertained that the injection of this latter substance into the blood produced precisely the same results as chloral itself, and probably with greater safety. It is possible, however, that as a substitute for opium and other narcotizing substances the hydrate of chloral may come, before long, into more or less general use.

According to some late experiments, chloral, no matter what the dose, when first administered produces a period of excitation; and with a small dose the action goes no further. If the dose be sufficiently large, the excitation is followed by a condition of anaesthesia. Very large doses cause death, which is preceded by a decided lowering of the temperature.

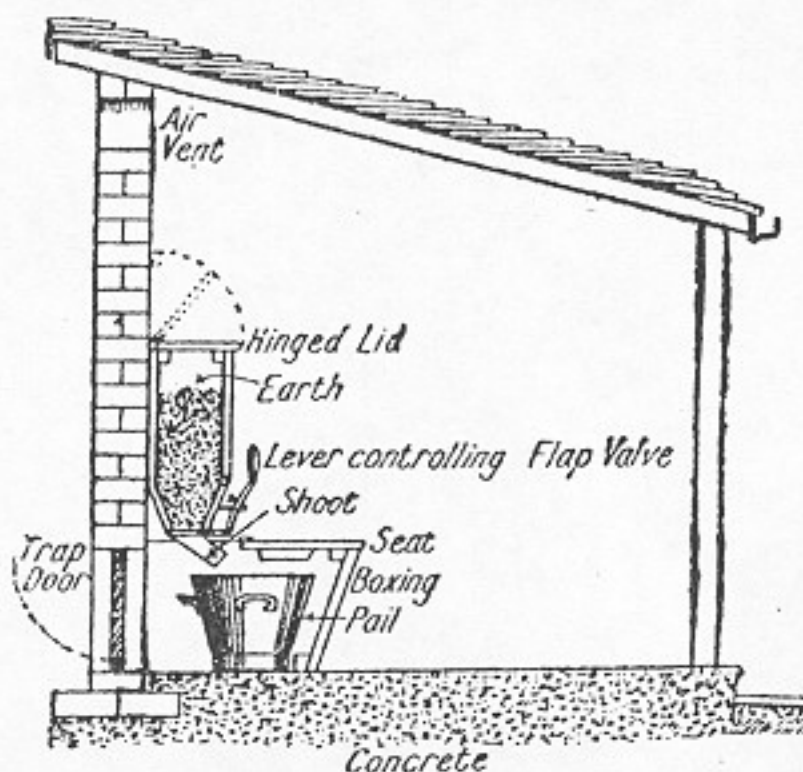
EXTIRPATION OF SPINAL CORD.

We are assured, by some recent experiments, that if from one-fortieth to one-twentieth part of an inch be removed from the spinal cord of a frog in the winter season, it will afterward be reproduced, so as to enable the animal to resume its nervous functions.

ARTIFICIAL FOSSILS.

An English investigator, Dr. B. Richardson, has recently made some curious experiments in attempting to produce what may be called artificial fossils. One of the most successful of these illustrates how animal matter, under pressure and heat, may be made to leave a permanent record of its form in the mineral substance in which it is imbedded. Some plaster of Paris made into a fluid with water containing alum in solution was poured into an iron box or "flask" until the flask was half filled. The body of a dead fish, a common sprat, was cut in halves transversely, the two pieces were laid upon the plaster, and the flask was filled up with fluid plaster and closed. When the plaster was firm, the flask was placed in the iron chamber described below, with four ounces of water, and the temperature was raised to 340° Fahr., and was sustained at that degree for an hour. Twelve hours afterward the flask was laid open, and the plaster cut in halves, when two moulds were found, one of the upper, the other of the lower half of the fish. The markings of the body of the fish were delineated on the mould; a small portion of the spi-

first step toward a sound policy of recycling waste would be the wood-flour toilet.



Earth Closet. Sectional diagram showing method of Construction and hopper for earth supply

Shown here is the earth closet from a 1920 encyclopedia. Although earth closets are still manufactured, the weight of the soil and its disposal would make it impractical for urban areas or even small towns.

What I've come up with is wood flour. This would be practical, even for a penthouse.

Billions of tons of tree trimmings, stumps, paper, sawdust, scrap wood and other wood waste are burned each year. This is because it's in the way and has too little economic value to route to a central collecting point. But as wood flour, wood waste could be used for sanitation, power, fuel, food and chemicals.

First, however, we must make the wood flour. Imagine a four foot thick, eight foot long drum covered by a 1/4th inch sheet of steel. Before being bent around the drum the steel would be nicked evenly to make the entire surface like a rasp.

The points would project just under 1/16th of an inch by the same width. The drum would be in a large hopper, with its edges flush with the points.

Turning at several hundred RPMs the drum would flour several hundred tons of wood waste each day. What would be left of the leaves, branches, twigs, bark, sawdust, paper, etc., would be a fluffy powder with the consistency of cornmeal. It would be highly absorbent of both liquids and odors. The tree trimmings would also give the flour a pleasant odor.

Some of the wood flour would be subjected to destructive distillation, producing wood gas, pyroligneous acid and charcoal. The wood gas would be piped under the stil as auxiliary fuel. The pyroligneous acid and charcoal could be processed into dozens of valuable chemicals.

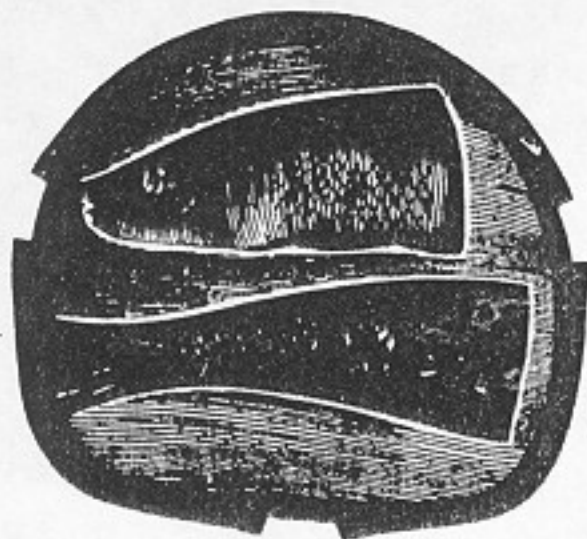


FIG. 3.

nal bone was left; a dark colored fine spot, surrounded by a shiny scaly substance, indicated the position of the eyeball; a little filamentous debris remained, consisting probably of the scaly covering of the animal. (Fig. 3.)

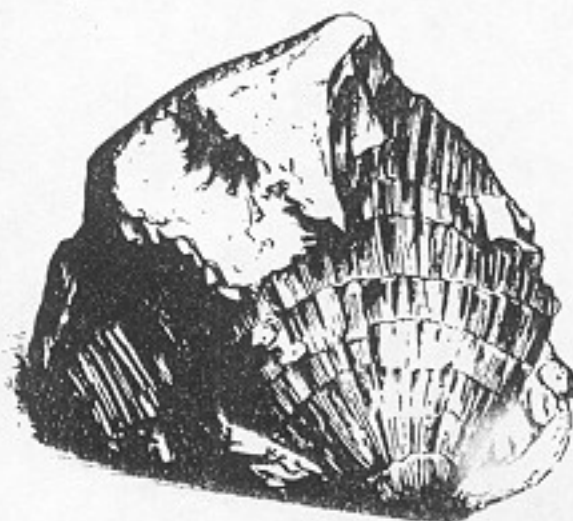


FIG. 4.

The body of a frog or toad submitted to the same treatment in vegetable carbon or in sand was altogether destroyed, and its form was wholly lost; but in plaster of Paris the impression of the body was beautifully marked. When an oys-

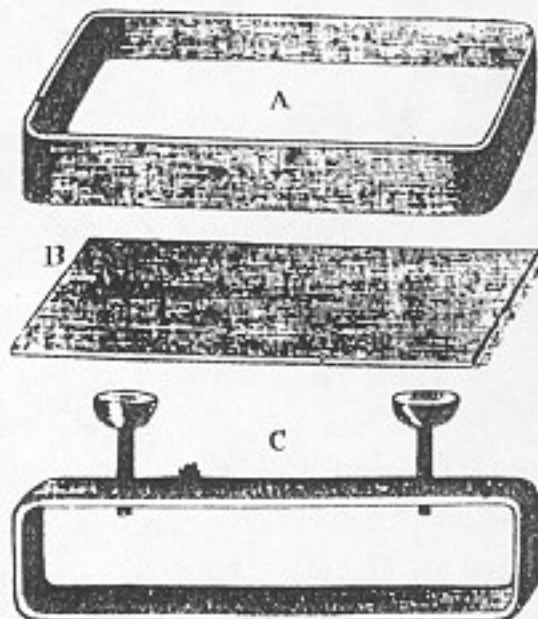
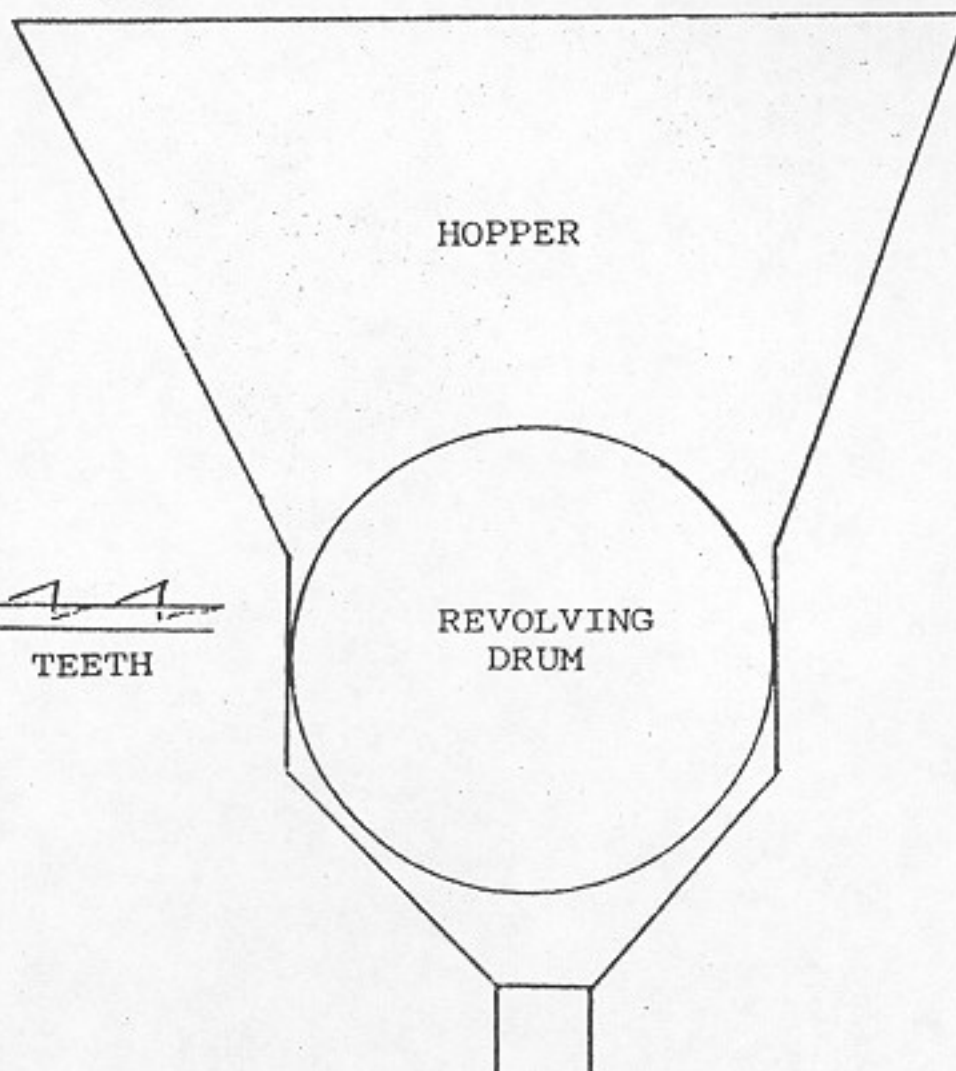


FIG. 5.

ter-shell was imbedded thus in plaster of Paris the form was preserved as in Fig. 4.

The apparatus used for these experiments is indicated in Fig. 5. A is the iron box or "flask;" B a loose lid; and C a band with compressing screws. The bottom is also loose like the lid, so that when the cast is to be taken out the top and the bottom of the flask can both be removed, and the block of plaster cut out with a fine key-



HEAVY-DUTY GRINDER-SHREDDER

All plant cuttings, bones, wood, sawdust, etc., will be dumped in. It will revolve about 1,000 RPMs and all the debris will disintegrate to pin-head sized bits and will sink down through pipes leading to the digesters.

Safety will demand two operators, one at each end before it will work. This will guard against anyone accidentally getting in and thereby disappearing without a trace.

Sawdust, as such, does not make good charcoal or distil well. However, it could be compacted by a hydraulic press to form billets of the right size and consistency for destructive distillation. This alone could be a great profit in recycling.

But wood flour's greatest use would begin in the toilet. It would revolutionize all sewage systems. During the last drouth, a conservationist said that if every family should put a brick in the flush box it would save billions of gallons of fresh water. But why not save it all?

Also, why should millions be spent on sewage processing plants? To utilize the sewage would cost nothing except wages, and the return in by-products would more than pay those wages.

The first step in utilization of sewage would be a variation of the earth closet. Instead of a bucket, as in the illustration, the receptacle would be a three or four-ply paper bag about 25 inches high and about like a feed sack. These sacks would be free and delivered full of wood flour by the Sanitation Service as they took the used wood flour away. The sacks could be made

hole saw. The flask, when thus prepared, was subjected to heat in the common vulcanizing apparatus used by dentists.

PREPARATION OF GYPSUM FOR CASTS.

A recent improvement in the preparation of plaster of Paris, for taking fine casts, consists in the addition of powdered alum in a small proportion to the calcined plaster, and then heating it a second time to a red heat. Casts made of plaster thus prepared have an appearance very similar to unglazed porcelain, with the translucence of marble, and a fine lustre, so that they can scarcely be distinguished from polished marble, to which they do not yield much in hardness.

EXTINCTION OF FIRES.

A recent German writer, in discussing the general theory of fires, and the best method of preventing and extinguishing them, mentions various mineral substances which may be mixed with the water employed, to give to it much greater efficiency. Chief among these, in his opinion, is common salt; and he maintains, as the result of actual experiment, that one part of water containing salt will have more effect than four without it.

He explains its action by explaining that a saline solution is less readily vaporized than pure water, and that it is not so easily decomposed into its constituent elements of oxygen and hydrogen, which, of course, tend to recombine, and produce a still greater intensity of combustion. He thinks that the salt itself also, falling on hot coals, is decomposed, its sodium combining with the oxygen of the water; but that the hydrogen of the water unites with the chlorine of the salt, and forms a completely incombustible gas, which has a very favorable effect in deadening the flame, and aiding in extinguishing the fire.

There is no danger of injury to the fire apparatus attendant upon the use of salt-water, provided it be subsequently flushed with fresh-water from the hydrant. Our author advises that a supply of rock-salt be kept in bags in every engine-house, and, as soon as a fire breaks out, that the solution be made. It is not necessary to have such a solution saturated, as a large percentage of water may be added without materially affecting the efficiency of the mixture.

An important preventive of fire is suggested in the coating of the beams and timbers of newly-built houses with soluble glass, applying this in several successive coats of a rather dilute solution, to be followed by a final application of a mixture of soluble glass and cement. Wood treated in this way may be exposed quite close to burning matters without actually taking fire.

FRENCH METHOD OF PREPARING HAMS.

Among the novelties, to the European public at least, exhibited during the Paris Exposition of 1867, and one which took a prize for excellence of result, was what was considered as an improved method of curing hams. This consists essentially in the injection of the pickle into the meat by means of hydrostatic pressure, a reservoir of the liquid being kept in an upper story, with a strong rubber tube passing downward, about twenty feet below, and terminating in a pointed metallic nozzle, the passage of the liquid through which is controlled by a stop-cock.

The point of this nozzle is to be inserted into the ham, and the cock opened, when the pressure from above quickly forces the solution throughout the ham, causing it to expand very materially, and to take up a sufficient quantity of pickle in a very short time. This appears to be the principal point of novelty. The general excellence

from wood waste chips and could be a separate industry financed by the sale of the by-products.

You would empty the bag of wood flour into a hopper built behind the toilet about where the flush box is now. After each use, wood flour would go into the bag, spread evenly about a quarter of an inch per flick of the lever. When a new bag was installed, the householder would give the lever a couple of flicks and then a flick or so after each use.

The bag would be wide open and a secondary toilet seat with a rim jutting down a couple of inches would fit into the bag's mouth. When the bag was filled about 18 inches the main toilet seat and the secondary one would be lifted and a twisted paper drawstring would be pulled, closing the bag. Then it would be lifted out and put outside in its own receptacle.

You may not consider this esthetic. But what toilet is? Do you enjoy cleaning your toilet bowl? And how about when the toilet won't flush? No more such problems. Instead of looking into a toilet bowl filled with water, you'd just see a layer of clean, odorless wood flour. Your water bill would be about half and your plumbing bill would be zero.

When the Sanitation Service picked up your bag or bags and left you a like number the used bags would be taken to a disposal hopper. This one would accommodate all organic matter and here your waste would be dumped, bag and all. It would then be re-ground and would be piped to a large methane generating vat. Water would be let in and the contents would be automatically stirred and would ferment, creating methane, which would be piped into the fuel gas system.

When the methane had been exhausted the contents of the vats would be practically germ-free. The next step would be to let the organic matter settle. Then the nearly clear, mineral-rich water would be siphoned off into algae troughs. (See *Algae*, SURVIVOR 6).

There are many algae and most double their volume every 24 hours. *Chlorella* and *Spirulina* are the most popular, both having a high protein content, fats, minerals and vitamins. The algae would be dried and, mixed with other food, fed to chickens, fish and livestock.

The slurry left when the water was drawn off would be piped into shallow, screened-in trays where flies would be introduced to lay eggs. The trays would be layered with screening which, when water was sprayed on the spent slurry, would drive the slurry through, leaving the fully grown fly larvae. (See "The Fantastic Fly", *Survivor* 6).

These larvae, or maggots, have a very high protein and fat content and are perfect food for fish and chickens. Dried and ground, they would be mixed with stock feed. Their oil could be sprayed in the toilet bags by the manufacturer to make them moistureproof.

of the hams exhibited, however, resulted from the great care used in the preparation of the pickle (which must always be of the same density of solution), the injection of a definite amount of the pickle for each pound of meat, and the allowing the hams to soak for a few days after injection in a solution of the same degree of strength as that previously used.

The hams are to be hung up in an upper room of the building, and exposed to the smoke and hot air from two chimneys, the hearths of which are in the lower story, and on which dry oak wood is allowed to burn and smoulder. A thermometer regulates the temperature of the upper room; and the combination of the dry air with the smoke is considered to be a matter of prime importance.

CHLORAL AN ANTIDOTE TO STRYCHNINE.

Among other applications of the new anodyne, hydrate of chloral, it is said by Dr. Liebreich to be an antidote for strychnine, so efficient, indeed, that doses of the poison which would be fatal under ordinary circumstances are rendered entirely innocuous by the chloral, provided the remedy be applied immediately after the poison is taken. On the other hand, strychnine will be available as an antagonist to chloral poison; and although no authenticated cases of this latter character have yet been reported, some may possibly arise hereafter, and it may be well to bear the facts just mentioned in mind.

COMPRESSED GUN-COTTON.

A VERY important memoir has recently been communicated to the French Academy of Sciences, by Mr. Abel, relative to a method of using gun-cotton so as to produce an explosive effect equal to that of nitro-glycerine or dynamite, while much safer in its application. If gun-cotton be laid loosely on any surface and ignited by contact of a lighted match or red-hot iron, a rapid combustion ensues with a dull sound, but without explosion or violent effects. When the cotton is compressed into a compact mass and then touched off, the combustion is much slower; and indeed this burning can be retarded to such a degree as to exhibit a smouldering slow fire, without appreciable flame.

If, now, a detonating percussion powder be introduced into the substance of the compressed cotton, and ignited by a battery or a fuse, the result is entirely different. A violent explosion will ensue equal in destructive effect to that of nitro-glycerine (which, like dynamite, is set off in the same manner), and incomparably superior in intensity to that of gun-cotton treated in the ordinary way.

If, again, several masses of compressed gun-cotton are laid at short distances apart, and one be ignited by means of percussion powder, all the rest will go off with explosive effects similar to that of the first. Furthermore, the action of gun-cotton thus exploded upon any given object, as a rock or block of wood, is much the same whether inclosed in the interior of its substance or simply laid on its surface; a fact of the utmost importance in blasting and mining operations. If, as seems to be the case, the mere application of the cotton, or its insertion in a natural crevice, will answer the same purpose as its introduction into a hole made for its reception (as in blasting with gunpowder), tamping, so productive of dangerous results, will be entirely dispensed with. In submarine blasting, the charge needs only to be inclosed in a water-tight bag, or a glass bottle, and laid on the surface, or inserted in a crevice, and exploded by means of a battery. The removal of rocks or large

When the fly larvae were removed, the slurry would be partially dried and earthworms would be put in. Earthworms are simple to raise and very prolific. They also have a high fat and protein content. When the earthworms have digested all the slurry they would be separated from their castings. The worms would then be fed fresh to chickens and fish or dried and ground to be added to stock feed. The castings would then be added to garden soil.

So you see, using up nothing, destroying nothing, polluting nothing, every town and even city will be more sanitary and prosperous. Prosperous since the whole program could be orchestrated by the Sanitation Department, either municipal or privately owned. Since the by-products would go into value creation, there should be no direct cost to the citizen.

Since it would be run by Sanitation, the regular garbage could be included. Instead of going to polluting landfills, dumped at sea or burned outside, all the garbage would be recycled.

At Central Sanitation, all the garbage would be dumped onto a huge moving belt. Metal, plastics and glass would be taken off the belt and put into separate receptacles. All organic garbage, including toilet bags, would go to the end of the belt and be dropped into the grinder.

Concerning industrial pollution, every industry would have to recycle all wastes or go out of business. There would be a law saying, in effect, that if waste could not be utilized, it could not be generated.

Thus, no effluent from factories could be poured into rivers and streams. It would have to be discharged into evaporating ponds or its liquid distilled.

To impose such restrictions on our major industries would be to saddle them with prohibitive costs. When they were built, years ago, no such restrictions were planned for. But as new industries are built after the collapse, waste recycling will be a major factor in design.

Even now, however, smokestacks, causing acid rain and destroying forests and lakes all over our planet could be stopped. Great heat energy pushes the pollution up from the furnaces to the outside. This energy could be harnessed to force the pollution through water, trapping it where it could be removed, dried and its chemicals recycled.

As I touched on near the beginning of this article, steam cars would largely replace internal combustion-driven cars. They could be fueled by methane or alcohol and thus, would not pollute to any great extent.

Steam cars could also be powered by lenses. (See Burning Glass, Survivor 1, page 404, Solar Power of the Past, Survivor 3, page 944 and Energy From the Lens, Survivor 5).

Mounted on the rear, the computer-directed lens would focus on the heating element. This would only work during sunlight. But at night or on cloudy

stones in roadways or in the fields, can be effected by simply laying a mass of compressed cotton on the surface, and discharging it as explained above. To shatter the strongest gate, or to demolish a building, it is only necessary to explode a pad of cotton hung against it. Ice may also be cleared away in a harbor or around a vessel by this means with the greatest ease. Other applications will readily suggest themselves for the practical adaptation of this most important discovery, which hardly seems, so far, to have met the attention which it deserves.

DUALIN, A NEW EXPLOSIVE.

Among the many novel explosive substances which of late have been introduced to the notice of the public, dualin is said to possess the intensity and force of nitro-glycerine, with the persistent action of ordinary gunpowder. It consists mainly of saw-dust treated with nitro-sulphuric acid, already known for many years as Schultz's gunpowder, with the addition of nitrate of ammonia. This substance is said to have much greater explosive force than ordinary gunpowder, as all of its constituents are converted into gases; and it corresponds in many of its features to gun-cotton, being liable to the same objection of gradually decomposing under the influence of air and moisture.

It is said to be of about the conducting power of dynamite, and to be considerably cheaper. Its general peculiarities, however, as to safety of transport and handling, are not very well known; and we would hardly advise our readers to make much use of it, without having had it more thoroughly tested.

THE MAHOVOS.

Among other important novelties in mechanical science exhibited at the Paris Exposition of 1867, and brought to our notice by the admirable report of Dr. Barnard, of Columbia College, is one called the "mahovos," the invention of a Russian engineer, which, it is thought, contains the germ of an important improvement. This is intended to economize and utilize the power of a locomotive engine, and consists simply of a pair of fly-wheels of immense weight—started and kept in motion by the moving of the train—provided with a special tender, which runs immediately behind the engine. The practical application of the mahovos will be understood when we reflect that it is always necessary, in running a train, to have an engine capable of surmounting the highest grade on the road, and therefore more powerful than would be required for simply carrying the train along a dead level, where, of course, a certain amount of power is wasted. The object of the mahovos is to store up the surplus power and render it available upon the more difficult parts of the ascent, and thereby permitting a smaller engine to be employed, which would involve not only less expense in the outset, but a reduced amount of wear and tear of the road.

Referring to Dr. Barnard's report for the details of the apparatus, we may simply state that when the train is started the mahovos is of course set in motion, and the size of its wheels and axles is such that a speed of thirty miles per hour in the train will generate in the circumference of the mahovos a velocity of four hundred and sixty-six feet per second; and as it weighs about twenty-six tons, this velocity is supposed to embody a living force of more than one hundred and forty-four millions of foot-pounds. The apparatus, of course, is constructed of such material and in such a manner as to be secure against

days the methane or alcohol burners would be switched on.

So, although our species has some interesting times ahead, those who are culled will be replaced by a better class; us.

Then we will build a civilization which will last as long as it's needed. There will be no surplus population, no pollution and no environmental destruction.

I'll dwell on this in subsequent issues. But in the next, I'll outline the most far-reaching goal anyone ever imagined. We'll use all the old sciences to send our best beyond the stars.

If you aren't a subscriber I advise you to subscribe now. It might mean the greatest fantasy you could set your teeth in. If you are a writer, it could give you some of the greatest science fiction stories ever dreamed up. It will also be great fun.

any danger of bursting by centrifugal force, a matter of prime importance. As the train moves from a state of rest the velocity of the fly-wheels is gradually accelerated, and finally attains a maximum corresponding to the maximum of the velocity of the train. If now the steam be shut off from the engine the mahovos itself becomes a source of driving power, and will maintain the motion until it has given back the work stored up in it precisely as it was first received. To facilitate the necessary stoppages the friction-wheels of the apparatus can be lifted off from the running-wheels, so as to obviate any material loss of power. But if the stop is to be for a length of time the steam is shut off at a distance from the station, so that the power stored up may carry the train to its journey's end, and thus exhaust itself.

It is also so constructed that it may be used as a brake, an entire train being stopped in twenty seconds, which perhaps can scarcely be said of any other form of apparatus for this purpose.

The advantages to be derived from the use of the mahovos are summed up by Dr. Barnard as follows: first, the diminished cost of railways, in consequence of the admission of steeper grades than are now allowed; second, a reduction of the amount of curvature and an increase of the maximum radius, by which the mean velocity may be improved and the wear and tear diminished; third, the reduced cost of maintenance, on account of the reduced expense of the substructure; fourth, the greater durability of the rails and wheels, in consequence of being less frequently subjected to wear by the brakes; fifth, the saving of life and property, by the use of an instantaneous brake; sixth, great economy of fuel. The precise value of this apparatus will probably be known before long, as arrangements have been made on some of the Russian railways to put it to a thorough test.

GUN-COTTON IN BISULPHIDE OF CARBON.

According to Dr. Bleekrode, if gun-cotton be first wet with bisulphide of carbon (a highly inflammable liquid), and an electric spark be passed through it, instead of producing an explosion of the cotton, the bisulphide alone is set fire to, the gun-cotton apparently remaining intact among the burning bisulphide, presenting al-

most the aspect of a mass of snow slowly melting away. The experiment may be varied by using either benzine or alcohol instead of the bisulphide, and igniting it afterward with any flame. All these liquids yield the same result, and there is no danger in the experiment, even if large quantities are used. This curious phenomenon is explained by Dr. Abel, who says that "these results indicate that if, even for the briefest space of time, the gases resulting from the first action of heat on gun-cotton upon its ignition in open air are impeded from completely enveloping the burning extremity of the gun-cotton twist, their ignition is prevented; and as it is the comparatively high temperature produced by their combustion which effects the rapid and more complete combustion of the gun-cotton, the momentary extinction of the gases, and the continuous abstraction of heat by them as they escape from the point of combustion, render it impossible for the gun-cotton to continue to burn otherwise than in the slow and imperfect manner, undergoing a transformation similar in character to destructive distillation."

As a practical application of these facts, it is suggested that if gun-cotton be kept in a flask in a layer of benzine or bisulphide of carbon, the danger of explosion in case of a fire is obviated, since, if the liquid is ignited by any means, the gun-cotton will burn slowly and gradually. When required for use, a brief exposure to the air restores its explosive qualities.

CLEANSING FLUID.

A convenient preparation for taking out oil spots, and for cleansing articles of brass, silver-plated ware, and gold, is made by mixing together equal parts of caustic ammonia and spirits of soap; and this may be applied to a great variety of purposes in household economy.

FURNACE SLAG.

In Belgium, furnace slag is now utilized by allowing it to be run off into moulds along the sides of the furnace, in which it assumes the form of rectangular blocks of any desired size. When cold the mass forms a compact, homogeneous slag, very much resembling porphyry, and equal, for building and engineering purposes, to the best natural stone that can be procured from the quarry.

Wind Small Springs as you need them

A workshop expert tells you how it's done.

In winding any coil spring it must be remembered that when the tension on wire is released, the spring will expand somewhat, making it larger than the mandrel on which it was wound. There can be no set rule for allowing

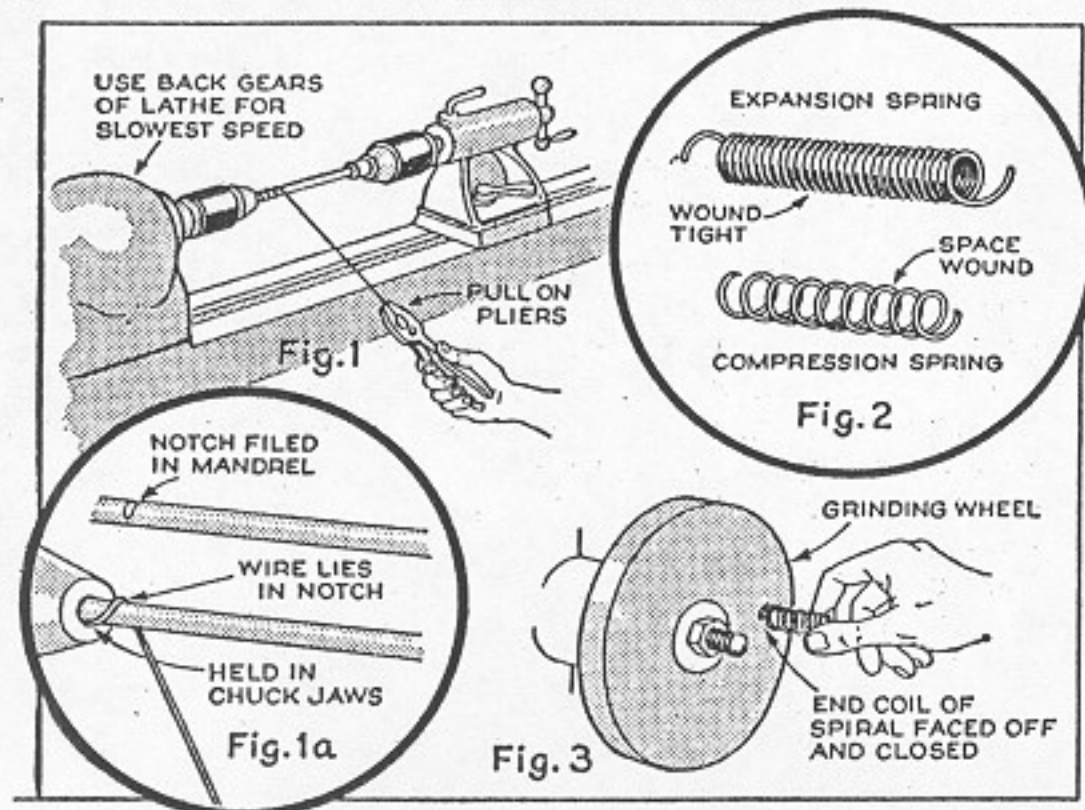
for this, as the expansion varies both with the size of spring, hardness of wire used, and tension at which it is held. Consequently I've adopted the plan of allowing for about 20% to 25% expansion; and, since it takes but a few moments to wind a small spring, no great harm is done

if I "misfire" on it.

Figure 1 shows the general plan for winding a small spring in a lathe. A nail, or any piece of steel rod about $\frac{1}{4}$ smaller than you think it should be, is held in any type of chuck available, and forms the winding mandrel. File a notch in end of mandrel ("a," Figure 1) to hold end of wire. When using a machine lathe, use the back gears and belt for lowest possible speed; hold end of wire in a pair of sturdy pliers, and pull strongly to supply tension. When springs are to be wound $\frac{1}{2}$ " or more in length, it is well to support the free end of mandrel in a hole in a piece of scrap stock held in the tailstock chuck, as shown. For shorter springs such support is not needed.

It is always advisable to wind springs a good bit longer than required, and cut them to the length needed; though when exact length is known, a square or "closing" coil ("b," Figure 1), is easily formed by a quick shift of the angle at which the wire is held, when reaching end of coil.

Figure 2 shows the difference between expansion and compression springs; when winding the former, hold the wire almost at right angles to mandrel, so that the coils touch each other; for



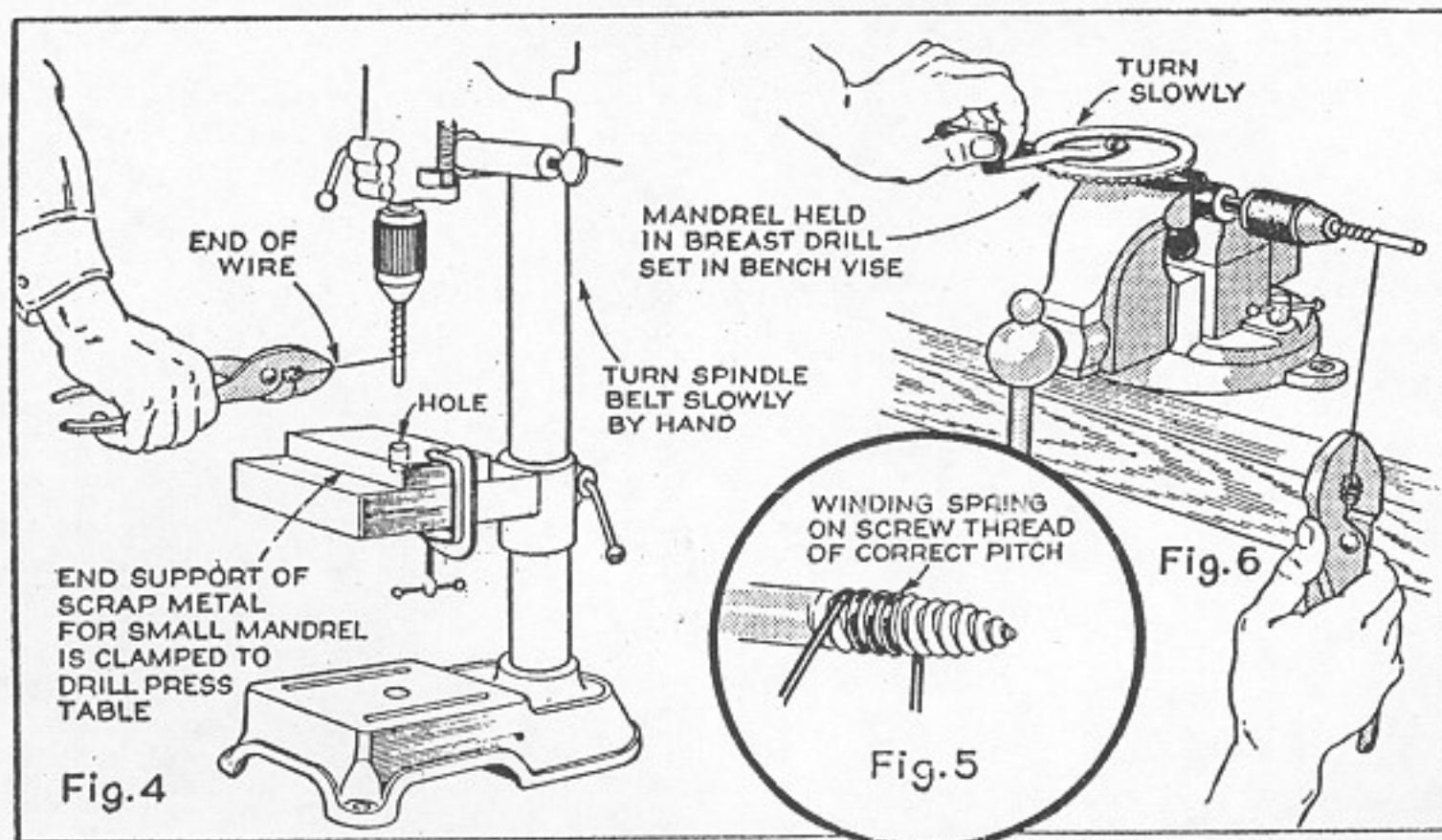
by Clyde Baker, U.S.N.

GUNSMITHING, miniature trains, airplanes, model work and various other projects frequently call for small coil springs, ranging in size from $\frac{1}{16}$ " to $\frac{1}{4}$ " or larger in diameter—and often not readily obtainable.

Mechanix Illustrated

October, 1942

Where only one or two springs in a given size are needed, they are easily made, either of steel music wire, brass or bronze wire as required, without special tools or special setup—particularly if you have any sort of lathe, though even a lathe is not essential.



the latter, the angle of the stock with the mandrel determines the spacing of coils. If spacing proves insufficient, hold ends of spring between pliers and give a quick pull to separate them.

Springs not wound with a "closing coil" may be finished to length and ends closed by holding lightly against side of grinding wheel, Figure 3. Light pressure heats the end coil red hot and brings it down squarely, without affecting the rest of the spring.

Figure 4 shows the same method of winding applied to a drill press, in case no lathe is available. When using a drill press, or a wood turning

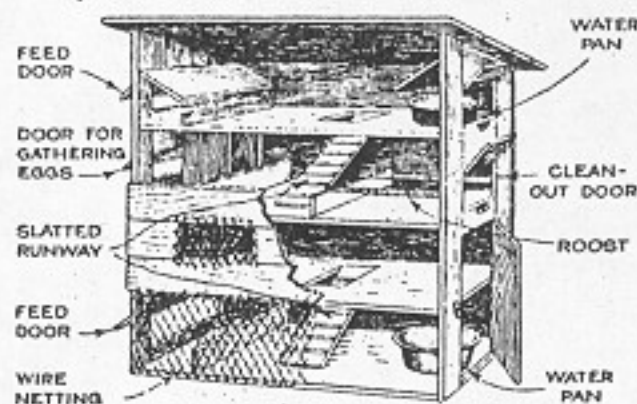
lathe on which back gears are not available, do not use power, but have an assistant turn the spindle at slow even speed by pulling the belt.

Figure 5 brings spring winding within the realm of the man who has no machinery at all; use the breast drill, held in vise as shown and have an assistant turn the crank with a slow, steady motion while you supply tension on the wire held in pliers.

For springs which must have their coils spaced with absolute precision, use a screw of correct diameter and thread pitch for a mandrel, Figure 6.

A Combination Rabbit Hutch and Poultry House Popular Mechanics, 1925

Lack of ground space prevents many city dwellers from raising rabbits and poultry, although they would like to do so. The drawing shows a combination rabbit hutch and poultry house that is sufficiently large to accommodate about half a dozen hens and the same number of rabbits. As the drawing shows, the combination coop is a four-decked structure; the two lower compartments are for the rabbits and the upper ones for chickens, or other poultry, each division being made about 1½ ft. high. Small doors, hinged at the top, permit water and food to be inserted easily; suitable doors are also provided at the opposite end of the coop for the removal of litter. Slatted runways are provided between the decks of the rabbit and chicken compartments, respectively.—



A Combination Poultry House and Rabbit Hutch by Means of Which the Dweller in Crowded Surroundings can Raise His Own Poultry and Rabbits

Keeping Hair Off Rabbit Flesh When Dressing It

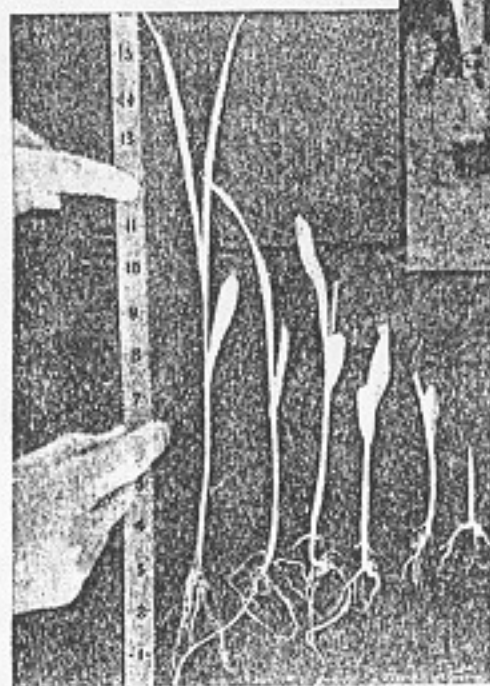
You can skin a rabbit without getting much of the hair on the carcass by dipping the animal in cold water before dressing it. The water causes the hair to mat and cling together so that, with ordinary precaution, the carcass will be clean. If several rabbits are to be dressed, change water frequently.



POPULAR SCIENCE MONTHLY April, 1933

Food for Cattle Grown in Metal Cabinet

A SYNTHETIC pasture contained in a sheet-metal cabinet seven feet high, and reported capable of supplying sufficient green herbage for a herd of twenty cattle has been devised by a German agricultural expert. The cabinet contains ten drawers in which tender maize plants sprout, their growth being accelerated by doses of a special solution of stimulating chemicals administered three times daily. Ten days from the time growth starts, a drawer is carpeted with thousands of delicate yellowish-green sprouts ready to be harvested.



Pipes supply doses of stimulating chemicals to the plants in this cabinet pasture. At left, samples taken one day apart show the amazing speed of plants' growth

By planting each drawer a day apart, a daily supply of about 550 pounds of fodder is assured. According to Dr. Paul Spangenberg, inventor of the synthetic pasture, it takes the place of from twenty to fifty acres of pasture land. He foresees that its application on a large scale would enable cattle to be raised with equal ease in the city or country. The artificial food, is said to provide an excellent diet, rich in vitamins.

"FOOL'S GOLD" HAS MANY USES IN FACTORY PROCESSES

Pyrite, which, owing to its yellow color, has so frequently been mistaken for gold as to earn the name of "fool's gold," actually is not the worthless material that the name implies, but has many important

commercial uses. It is employed in the manufacture of sulphuric acid and sulphite wood pulp, and in smelters it is used as a fluxing agent to furnish iron for the slag. It also is used to some extent in radios and jewelry. The largest pyrite deposits are in Spain and Portugal, but it is also found in western United States.

SCIENCE & INVENTION 1930

Parchmentizing Paper

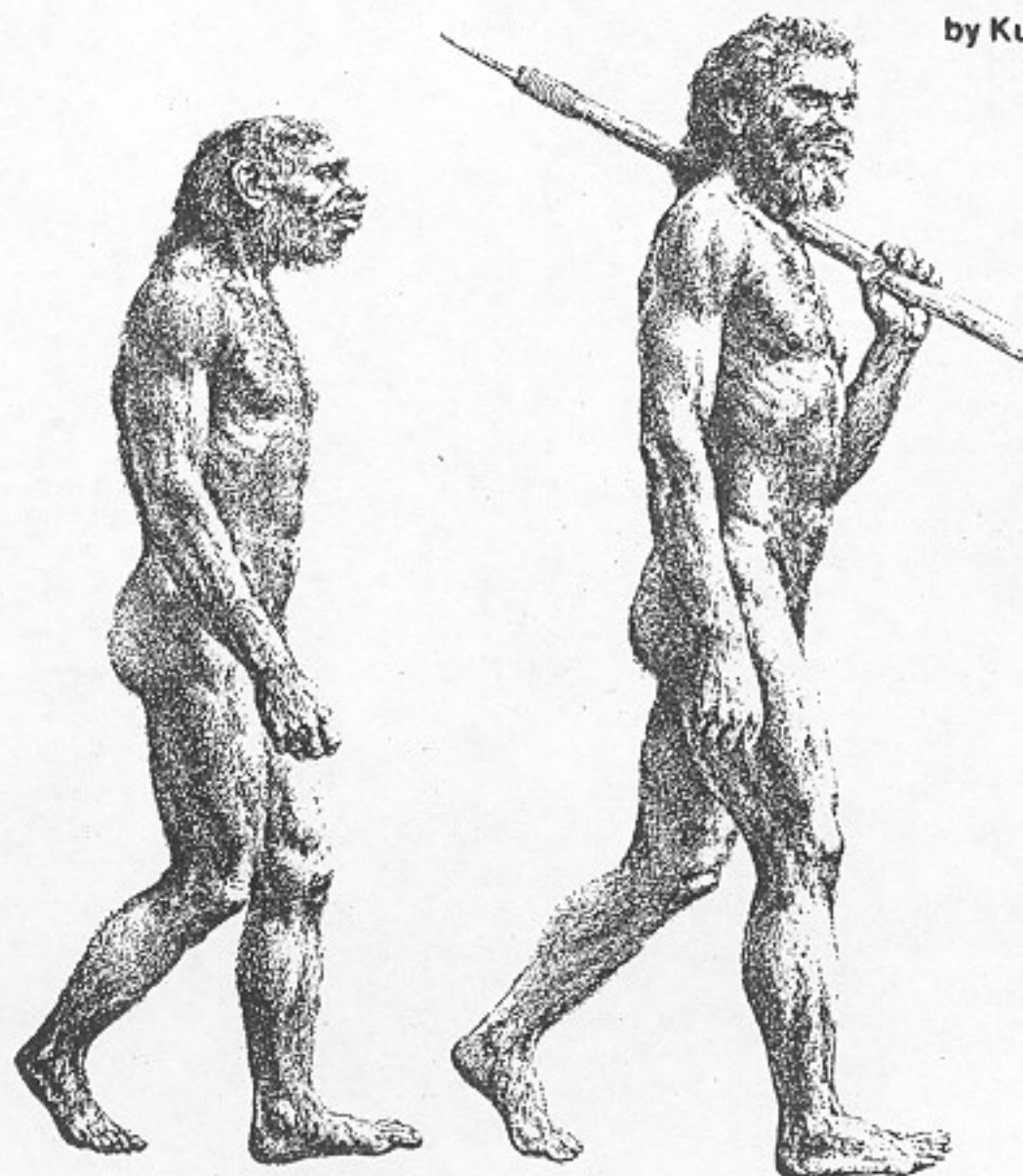
IN this day of lampshade making there is a constant demand for lamp coverings that will look antique. Common drawing paper of the white variety may be treated so as to resemble old parchment very realistically. A bar of paraffin is melted in an old pan. Then, the paper to be treated is placed on a large sheet of clean new wrapping paper which has been placed on a smooth, flat surface. Do not use paper with print on it as the ink comes off the paper to be waxed. A clean rag is dipped into the melted paraffin and rubbed, with a circular motion, on the drawing paper. This is done until the entire surface of the paper is covered with a thin coating of wax.



Now, a second piece of wrapping paper is spread over the waxed drawing paper. This piece is indicated in the left hand diagram above. A hot iron is applied to the entire upper surface of the second piece of wrapping paper. When a transparent spot corresponding to the shape of the waxed sheet appears on this paper the process is finished. The result is an artistic looking piece of parchment.—*Clyde McClary, Jr.*

EXTRA-TERRESTRIALS IN THE BIBLE*by Kurt Saxon*

Since 1947 when "Flying Saucers" first began to appear to pilots and then to just plain folks, extra-terrestrials have been almost a fad. A question is; where were they before 1947? Actually, such visitors have been reported periodically for centuries. However, before we called them extra-terrestrials, people called them witches, goblins and various other names for lack of a better frame of reference.

**EXTRA-TERRESTRIALS
IN THE BIBLE***by Kurt Saxon***NEANDERTHAL MAN**

Not nearly as brutish a fellow as his name has come to connote, Neanderthal man, whose peoples rimmed the Mediterranean and dotted Europe, had a cranial capacity in some cases larger than that of modern man. He made a variety of tools advanced in design.

CRO-MAGNON MAN

Only a cultural step away from modern man, Cro-Magnon man has left the world his art—cave paintings, stone engravings and carved figures. He replaced the Neanderthals in Europe and, diversifying in many populations, seems to have colonized the world.

It should be obvious that ETs would not want to be recognized as such. They would have had nothing to give to our witch-hunting, superstitious ancestors. Nor would modern ETs care to mix it up with our jet planes, unless they were numerous enough to engage us in total war.

But it's only in science fiction that armadas of space invaders attack Earth. Space travel would be undertaken by beings based on a home planet, to whom such endeavors would be scientific, exploratory and finally the last resort of a relative few escaping a

dying planet. War would be just too expensive, regardless of their economic system.

More realistically, the ships would leave the home planet singly as scouts and later with colonists. They would have a general destination based on astronomical calculations. Their destination might be simply a star cluster hopeful of having life-supporting planets.

The takeoffs might be a year apart and the voyages could take centuries. The scouts would explore likely planets and if a planet were promising, a crew might stay around for years, possibly with the intent to prepare the planet for habitation. This might entail anything from rearranging the planet's surface, changing its atmosphere, to modifying its life-forms to be of service to the prospective colonists.

Naturally, marker buoys would be planted along the route, reporting on the findings; intelligent life, if any, and possibly warning latecomers away from a particularly hostile environment or population.

Nearly every modern close encounter brings reports of little men with grayish skin, large eyes, slits for mouth and nostrils and totally unable to pass for human. So one can be excused for imagining ETs as totally alien, looking nothing like us. Modern ETs are most likely beings from a different star system than those who visited our planet ages ago. They are probably on their way to a planet more suitable. Whether or not our planet might do, we are too numerous, well-armed and potentially hostile to aliens for them to consider Earth a final destination.

Our own ancestors may have been ETs who got here long before our modern ETs left their own planets. Unlike our present series of visitors, the ETs who came to Earth thousands of years ago were much like us; possibly, not even superior to modern Western man.

It is likely that the ETs who figured so prominently in the Old Testament also

visited other races, upgrading the aboriginal from Neanderthal to Cro-Magnon. It could have taken thousands of years while successive groups tried to upgrade Earth's dull-witted savages to people who could be domesticated to the status of dependable servants.

There are still remnants of unchanged savages alive on Earth today. These are the Australian aborigines, New Guinea natives, African Bushmen and Pygmies, Amerindians and Japanese Ainus.

Most like the original Neanderthals are the Australian and New Guinea aboriginals. The Tasmanian aborigines, extinct since the early 1800s were so low on the scale of evolution that they could not conceive by Europeans.

Aside from the gods in the legends of so many of Earth's ancestral peoples, the most thorough record of ET visitations is in the Old Testament. To better understand what follows you should take time to read from Genesis through Joshua. Read it as you would any book on history, objectively, without belief or disbelief, but only for content.

Read it, knowing it to be the written account of oral tradition, experiences and observations of a people who honestly believed it to represent their god. If you read it thus, objectively, you will see a pattern of a logical progression of many generations of a people conditioned to the service of extra-terrestrials. Accounts which make no religious or philosophical sense are completely rational when serving the interests of extra-terrestrials.

If you read these first six books of the Old Testament you will recognize this pattern. The first part is the creation of modern man, or Cro-Magnon. Then there are periods of little or no contact. Then the Lord maps out the proposed territory of his chosen people.

The overall plan was to create and condition a race of servants, isolate them in a

territory of their own and then use them for a more or less permanent food supply for the orbiting ETs.

Genesis 1:26-27, "And God said, 'Let us make man in our image, after our likeness----' (27) 'So God created man in his own image, in the image of God created he him, male and female created he them.'"

Now we jump to the Garden of Eden. Eden was obviously a research facility where Neanderthals, lower animals and prospective plant species could be upgraded to usefulness to the ETs. Then, "And it came to pass, when men began to multiply on the face of the earth, and daughters were born unto them, that the sons of God saw the daughters of men that they were fair; and they took them wives of all which they chose." (Gen. 6:1,2 & 4). By the time the Homo-Sapiens were functional Cro-Magnons the ETs were between a rock and a hard place. They had raised Homo-Sapiens from congenital savagery to tribalists but feared a progression to a more civilized status, wherein the new man might be above ET influence.

Bible scholars have questioned why a tree of knowledge should have been in the Garden of Eden if man was not supposed to eat from it. If Eden were a research facility, the ETs were not only developing cereals and vegetables to adapt to Earth's soils and climate, but would have planted their own varieties to raise in greater volume than their own hydroponicums could accommodate.

The forbidden fruit was probably on a tree the ETs had reserved for themselves. (Gen. 3:1-7). It could indeed have been a mind-expanding drug which made New Man more aware than he was meant to be by the ETs.

At any rate, Cro-Magnon was developed and aware and no longer a part of a control group. So that facet of the mission was scrubbed and Man was evicted from Eden and Eden was abandoned to the weeds.

Years went by and ETs made overtures to Cain and Abel, descendants of their specimens in Eden. (Gen. 4:1-15). In their offerings to their Lord, Cain gave of the fruit of the ground while Abel gave sheep. The ETs rejected Cain's vegetables but accepted Abel's sheep. This turned out to be a diplomatic blunder.

Regardless of the size of the mother ship, the hydroponicums would not have provided the surplus needed to feed animals larger than rabbits and chickens, if they had them. The ETs, probably out of contact with our planet's surface for years, were starved for MEAT! And fat. After all, as it takes a surplus of vegetation to produce meat, it takes a still greater surplus to fatten that meat. Hence, the later taboo against the Children of Israel eating fat. (Lev. 3:17). The ETs wanted it considered as a delicacy reserved for themselves.

Had the ET graciously accepted Cain's offer, the first murder would not have been committed. But he rejected the offering and, in a fit of jealous rage, Cain killed Abel. The ET had to punish Cain but stopped short of killing him. People have wondered why Cain was protected from other men who might have killed him. But it was the ET's fault, hence the protection.

The next contact worth giving credence to came generations later after Terah, Abraham's father, left Ur of the Chaldees and settled in Haran. (Gen. 11:31). Then the Lord appeared to Abraham, (Gen. 12:7), while his nephew, Lot, was with him. It is most likely that Lot also saw the Lord, as he later knew an ET when he saw one.

Abraham's wife was barren, (Gen. 11:30), and in verse 18 we have a face-to-face, man-to-man conference between Abraham, the Lord and two of his lieutenants. The Lord's promise to cause old Sarah to have a child could only have been an example of artificial insemination. (Gen. 21:1-3). This chapter is both interesting and amusing so you ought to read it. It even has Abraham

pleading for the lives of those in Sodom and the surrounding towns.

Of course, the ETs meant to wipe out those towns, as that was their first recourse to any problem with Earth people. The excuse of "wickedness" on the part of the victims was only a story for those they were working with at the time. Otherwise, Abraham and Lot might have considered the ETs enemies rather than gods.

Read Genesis 19 as the most graphic account of ETs in the Bible. Verse 1 has the two "angels" approaching Sodom where Lot sees them and recognizes them for who they are. Bowing, he asks them to stay with him. They don't want to but he's probably attracting so much attention to them that they are forced to go home with him.

Next, the townsmen demand to know the strangers. For some reason later Bible commentators interpreted this "know" to mean carnal knowledge, as if the townsmen were a pack of aggressive homosexuals wanting to rape the strangers. That's nonsense. Lot lived in Sodom and knew the people. He would not have offered them his daughters had they wanted sex from the strangers. And of course, the townsmen were justified in their suspicions, as the strangers were indeed spies, scouting the town preparatory to destroying it.

But what follows is something all the commentators missed. The townsmen are trying to get in and the strangers "smote the men that were at the door of the house with blindness, both small and great, so that they wearied themselves to find the door".

Look, if you were trying to get into someone's house and were struck blind, you'd forget about the door in a hurry. They weren't blind in the sense that they couldn't see. They just saw a door where there was a wall and a wall where the door was. In short, the ETs used some kind of weapon or tool which caused their vision to be refracted.

Next day the ETs persuaded Lot and his household to flee the town, after which,

(Gen. 19:12-28), "The Lord rained upon Sodom and Gomorrah brimstone and fire out of heaven and overthrew those cities and all the plain and all the inhabitants of the cities and that which grew upon the ground". (28) "and he (Abraham) looked toward Sodom and Gomorrah and toward all the land of the plain, and beheld, and, lo, the smoke of the country went up as the smoke of a furnace".

Now, that's just the way a primitive would describe a nuclear attack. And if true, it couldn't have been anything else.

From Sodom until the time of the exodus from Egypt, the ETs were hardly in evidence. They may have been circling the planet or off exploring but they pretty much left the Israelites to their own devices for several hundred years.

When they returned, the people were living in Egypt. They were an underclass but not necessarily slaves; pretty much like the Palestinians in Israel today.

However, as their numbers increased, their loyalty was questioned, they were mistreated and they might have been wiped out. But the ETs decided it was time to collect them and settle them in the promised territory. Canaan was big enough and potentially rich enough to insure the ETs all the supplies they needed.

But Canaan was occupied by many small but well-armed kingdoms. And the Israelites were soft, at least as compared to their seminomadic ancestors who settled in Egypt during a famine. So the majority of them would not have wanted to leave Egypt. Nor would the Egyptians have wanted to lose their menials and domestics.

The ETs had a real problem. How to get a whole people to leave a place they didn't want to leave, to go to a place they didn't want to go to. And how to get the Egyptians to cut loose from a large block of their labor force.

Moses and his brother Aaron were to work on the people, agitating, preaching and

promising. Then the Egyptians had to be persuaded to release the people.

Exodus 10:1 has the first reference to the Lord hardening Pharaoh's heart. The phrase is repeated often. Scholars have long had trouble with that. For, if the Lord hardened Pharaoh's heart, Pharaoh was blameless. Some say it was just an archaic turn of phrase which didn't mean what it obviously did mean.

In envisioning a higher being, Bible scholars cannot accept the added misery of the people and the slaughter of Egyptian innocents as deliberate. But it was. The overall idea was to so alienate the Israelites and the Egyptians that the Israelites could not return to Egypt and so would be stuck with Moses, Aaron and the ETs.

In convincing Pharaoh of the ET's power, some of the tricks of Moses were duplicated by the Egyptian priests. Some could have been done by moderns with airships and some are beyond us, but not beyond the realms of a higher technology. Some are simply stories. One problem with some of these accounts is that some which scholars believe to have been made up are easily explainable by the presence of ETs.

In their dealings with the Israelites, the ETs constantly displayed a "heads we win, tails you lose" policy. Whatever worked, the ETs took credit for it. Whatever didn't work, they blamed it on backsliding by the people, or even the sins of individuals.

But there were many instances where this policy just couldn't be applied. Furthermore, whereas the ETs did their best to make the people believe that each of the many "Lords" were a single god, an overview of the incidents shows them to have been several different people, and actually superior only because of a higher technology.

For instance, Judges 1:19 says "And the Lord was with Judah; and he drove out the inhabitants of the mountain; but he could not drive out the inhabitants of the valley,

because they had chariots of iron". Now, if "the Lord" could not defeat people who had chariots of iron, then the Lord was no god.

Even so, there is a possible indication of what kind of tool or weapon the ETs were using. You may have a microwave oven, or at least you know about them. You've also probably heard of the Russians beaming microwaves at U.S. embassies and intelligence installations. The ETs might have refined microwave beams which could kill humans.

However, microwaves are nullified by metals. So although microwaves might have been used to kill primitive soldiers carrying no metals but swords and spear points, an iron-sheathed chariot would have nullified them.

Additionally, there is a humorous story in Exodus 17:9-12. During a battle with Amalek, Moses held up his hand. As long as his hand was up, his side won. When he tired and dropped his hand, the battle went against his side. When he was exhausted, Aaron and Hur each held up one of his hands and they carried on this farce until sundown.

You must realize that the position of Moses' hands could have had nothing to do with the battle itself. Surely his men weren't willing to let themselves be butchered just because Moses' hands were down.

So we can only suppose that they were getting help from above. One can imagine the ETs manning a hovering scout ship, seeing everything and zapping one Amalekite after another while they could see Moses' hands and then taking a break when he was tired. How they must have laughed at Aaron and Hur, each holding up a hand until sundown.

One story causing controversy for centuries is the one about Joshua arranging for the sun and moon to stand still so that one group of primitives could wipe out another group of primitives. Even saying it was the Earth which stopped revolving,

makes no sense.

However, that the sun and moon stood still may not have been a lie, at least insofar as the primitives would know. To people who never saw a light brighter than a campfire or torch after sundown, floodlights shining down from a space ship would indeed have given those people the impression that the sun and moon were overhead.

Then there is the Ark of the Covenant. After the ETs were long gone, the Ark was trouble. Many have speculated that the Ark was a receiving set whereby the high priests communicated with the ETs. But there is a strong possibility that, after the Ark had served its purpose and the ETs meant to depart Earth, they booby trapped it out of spite and frustration over their failure to utilize the people they had chosen to serve them.

Consider; in 1 Samuel 4:10-11, the Ark was captured by the Philistines. The tale of Dagon, the Philistine god, falling before the Ark, was obviously made up later by an Israelite. What is interesting however, is that the Philistines were smitten with "emerods", (tumors) and many died. (1 Sam. 5:6-12).

Had the ETs been around, the Ark would not have been taken. Also, the booby trapping was probably done with radioactive material. The Philistines crowding around their trophy had gotten radiation sickness.

Later, in verse 19, an inflated figure of 50,000 were smitten.

In 2 Samuel 6:6-7, Uzzah touches the Ark to keep it from falling and drops dead. That may have been a heart attack but was more likely an electrical charge. It does seem reasonable to believe that when the ETs were circling Earth the Ark was a sending and receiving set powered by electricity and protected from the uninitiated by a lethal jolt. So whatever was in the Ark or on it, it was not to be touched, looked into or crowded around. There's no way of knowing exactly what kind of power the Ark had, but

it was obviously power from another and a more advanced civilization.

On reading the Bible, one might ask such questions as why wasn't Aaron punished for making the golden calf and why did the Lord kill Moses? Neither question can be answered from a religious standpoint but both are simple when considering the interests of extra-terrestrials.

The ETs didn't really do anything for the people. And when you read of the huge amount of livestock sacrificed to them you'll understand why the Israelites had to be convinced the ETs were not men from another solar system, but gods.

The sacrifices were the core of the matter. The people were taught that they were burnt and their smoke was a "sweet savor unto the Lord". Of course a lot was burnt for effect. But it's only reasonable to suppose most of the meat was transported up into the ships. Also, the ETs ate just like you and I.

Exodus 25:29-30 tells of the Lord's eating utensils. The altar in the tabernacle was not an altar but a cookstove. Altars don't need grates. (Ex. 27:3-4). Exodus 29:22-25 even describes the Lord's menu. Aaron was most likely the Lord's chief attendant and even his cook. (Ex. 28-30).

So Aaron was as close to the Lord as anyone. Had Aaron believed the Lord(s) to be a god or gods he would not have made the golden calf, (Ex. 32:1-5), no matter what the people wanted.

Aaron was an opportunist who played on every side. He told Moses one of the biggest whoppers in the Bible and his trusting brother probably believed him. (Ex. 32:21-24). Actually, the ETs needed this cynical opportunist as a front man, so Aaron was spared.

But Moses was a different matter. His main work was finished but "his eye was not dim, nor his natural forces abated", Deut. 34:7. Bible scholars give all kinds of reasons why Moses was kept out of the Promised

Land but Deut. 34:4-7 gives none. The truth may be that it would not do for the honest and sincere Moses to blow the ET's cover as he sat around the camp fires reminiscing about his closeness to the Lord.

Going back to the hardening of Pharaoh's heart, we can only suppose the ETs had coached Moses and Aaron to be so arrogant that Pharaoh could not give in without seeming weak to his people. What with the demonstrations of Moses' (ET) power, Pharaoh was challenged and so could not back down.

At any rate, the Israelites got away only to end up in an inhospitable desert with the Promised Land before them. It seems the ETs really believed the Israelites, softened by centuries of peace and relatively easy living, could just march into Canaan and take over.

But the ETs were people, not gods. The land they had promised the Israelites was not theirs, nor was it known to them. From their ships it looked like only small villages surrounded by many miles of nothing. Had they had god-like knowledge there would have been no need to send spies. Read the 13th chapter of Numbers and you'll see that the ETs had no idea of the strength of the Canaanites.

In the same chapter the spies return and ten of the twelve report that the territory cannot be taken by the Israelites. You want screaming and bitching? Read chapter 14 of Numbers where Moses nearly lost his life to the now angry mob. The Lord intervenes and saves Moses and Moses has to talk the Lord out of killing the lot. So instead of killing them and being proved an incompetent for setting the people a task which they simply were not up to, the Lord laid all the blame on them. Then the ET did the only thing possible to save the mission. In decreeing that only those under twenty years of age and their children should see the Promised Land, he not only saved face but guaranteed that when the real campaign began, only the young, the toughened and

the fanatic would be in the battles. (Num. 14:26-35).

Although the warring lasted for many years the Lord was not able to help the Israelites to take all the land promised, as you'll see if you read the whole of Joshua chapter 13.

Even so, the tribes had been so conditioned for war that they had to fight anyone and each other and so had no time for the Lord. So he/they said to hell with it and left. It's hard to tell when the ETs actually left. The books after Joshua have the tribes so embroiled in petty intrigues and fratricidal wars that not even real gods could have kept their attention.

Needless to say, whatever the ETs had planned for the Israelites they failed miserably. Not only did they fail in the promise, but their "land of milk and honey" was just about the worst choice ETs could have made for their servants. It was a main caravan route, hotly contested by the Egyptians, Philistines, Syrians, etc. It's been an international battleground for thousands of years; the last place a real god would choose in which to be served by a people of peace and plenty.

Actually, the first six books of the Bible read more like science fiction than religion if you only put the tale in its proper perspective. Just imagine you were one of the numerous Lords (Captains) visiting this planet off and on for centuries.

Your ancestors had turned a race of Neanderthals into Cro-Magnons who believed ETs were gods. Now it's your job to mold them into a race of obedient servants with their own defensible territory who will supply your orbiting people with all the planet has to offer.

That's what the ETs wanted. They did their best to isolate the Israelites from foreign influence. They used all their technology to make the Israelites believe the ETs were gods to whom magic was natural. They gave them endless laws and rituals to keep them so busy

they wouldn't have time to think.

But they couldn't give the majority of the people what they needed to achieve the good life, and the freedom to think and to create. So the ETs melted away, leaving little more than legends and ceremonies to remember them by.

There is no reason for us to feel

harshly toward the ETs. Nor need we be grateful, since all they did was for themselves. But they were, literally, our creators. First by genetic selection and then by artificial insemination and mating. So, in a sense, they haven't gone. They're here; they're us.

Compass Improvised from Ruler Gives Accurate Radii



Here is a good compass that anybody can make from a five-cent ruler. Holes to take a lead pencil are drilled in the ruler at $\frac{1}{4}$ -in. intervals, locating them at slight angles across the face of the ruler so that they will not break into each other. To get them exactly on line with the $\frac{1}{4}$ -in. divisions, it is a good idea to lay them out with the aid of a small try square. A pivot hole must be drilled exactly on the center of an inch mark on the ruler.

Garden Hose Makes Window Squeegee

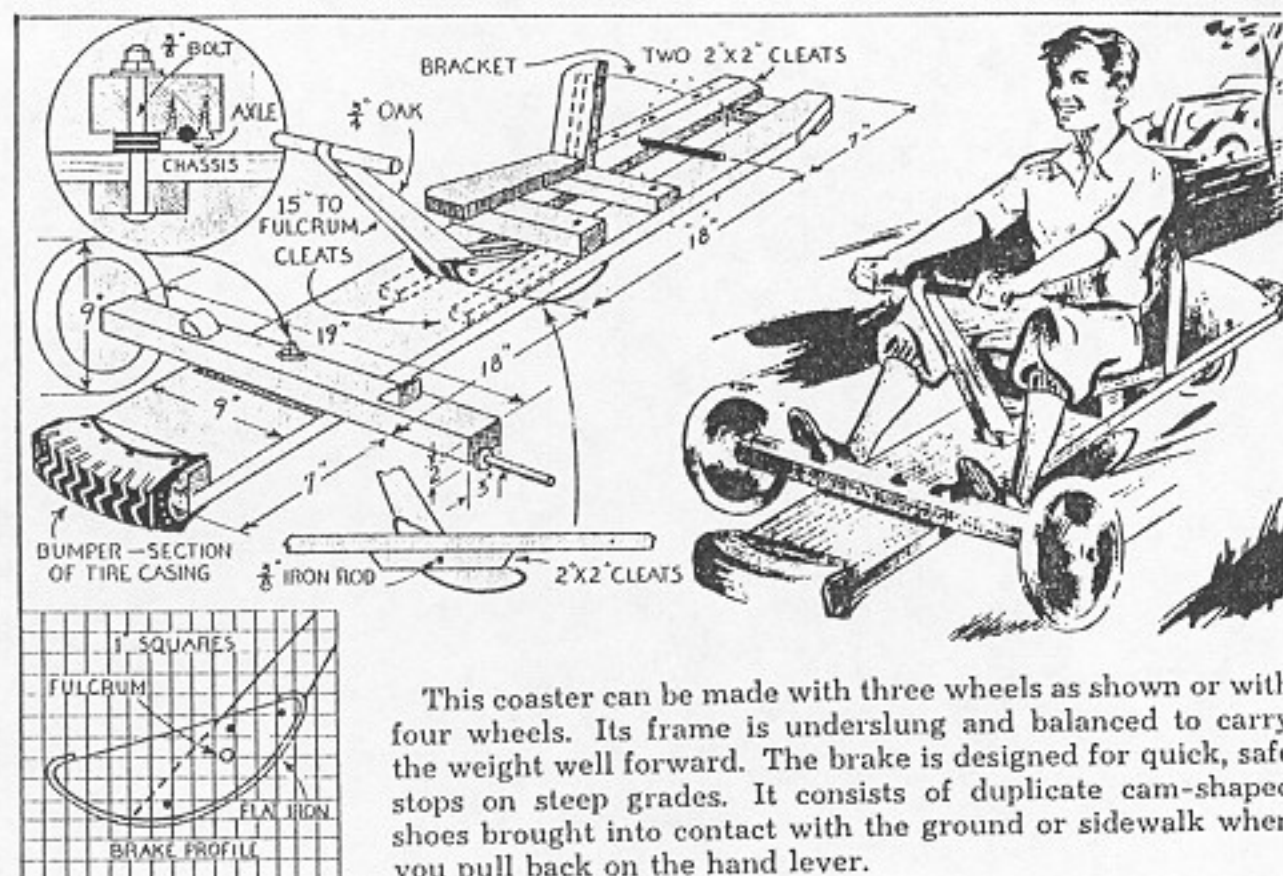
Popular Mechanics, 1925

An old broom handle and a piece of garden hose can be made into a squeegee, for scraping the water from windows without the necessity of wiping the glass with cloths, or for scraping water and slush from sidewalks. A piece of the broom handle is cut to a semicircular section and covered with a piece of garden hose which has been split in half and tacked to the wood. A suitable handle, as shown in the drawing, completes the tool.



POPULAR MECHANICS JUNE 1939

This Coaster Has Drag Brake for Quick Stops



This coaster can be made with three wheels as shown or with four wheels. Its frame is underslung and balanced to carry the weight well forward. The brake is designed for quick, safe stops on steep grades. It consists of duplicate cam-shaped shoes brought into contact with the ground or sidewalk when you pull back on the hand lever.

GODEY'S LADY'S BOOK AND MAGAZINE APRIL, 1872

CONFECTIONERY DAINTIES.

Marmalade Cakes.—Mix together a quarter of a peck of flour, with half a pound of refined sugar dissolved in ten spoonfuls of water, half a pint of yeast, a pound of currants, two ounces of candied lemon-peel, cut in thin slices, half an ounce each of cinnamon and mace grated, a quart of milk, ten eggs beaten up, and about a pound of orange marmalade. Bake the cakes at a moderate temperature, and ice with loaf-sugar and white of eggs.

Banbury Cakes.—Take three pounds of currants, a pound of butter, four ounces of loaf-sugar, a quarter of an ounce of mace, with the same quantity of cloves, and half a peck of flour. Then make it into a paste with boiled milk, and three-quarters of a pint of yeast. Place the dough near the fire to rise, knead it well before it is made into cakes.

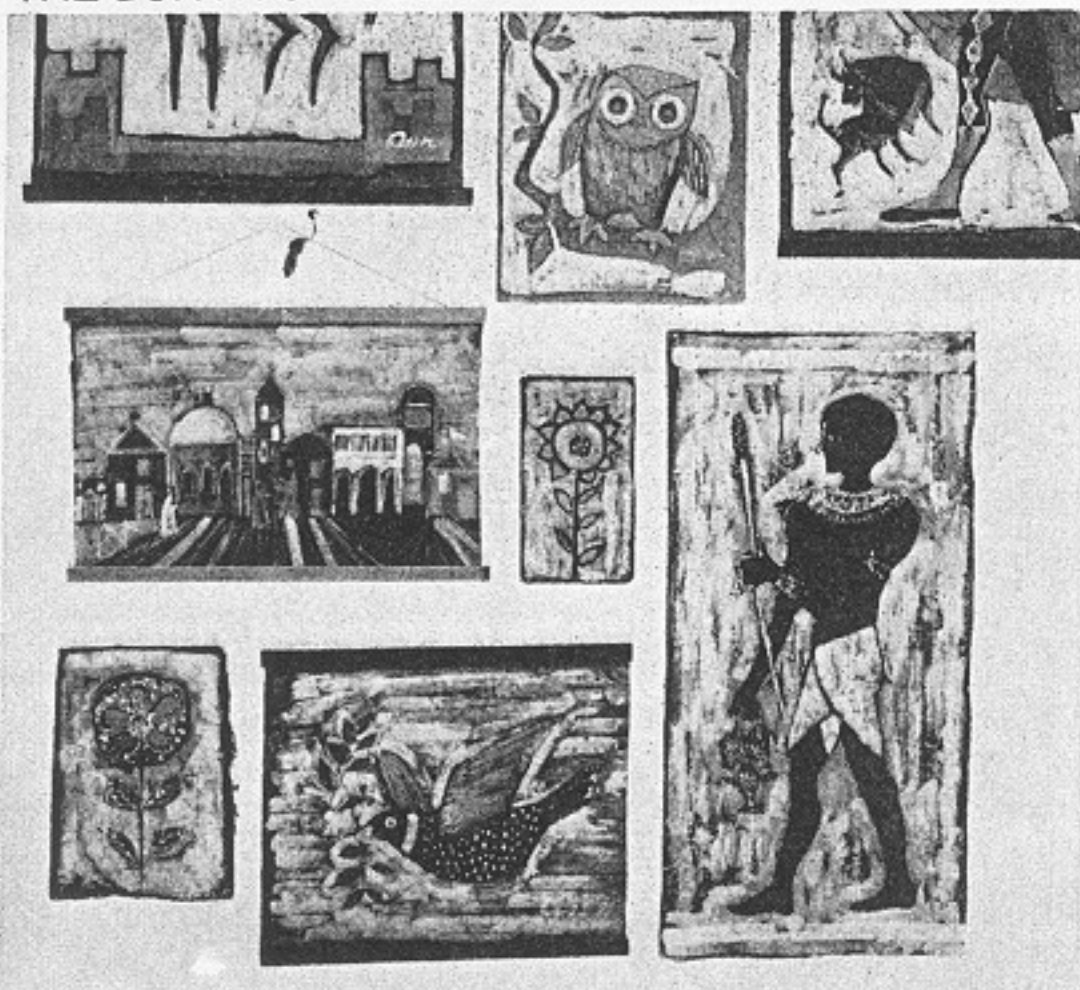
To make a Hedge-hog in Confectionery.—Beat up about two pounds of blanched almonds with a little water and sherry into a stiff paste; then pound up with it a pint of cream, twelve raw eggs, and enough loaf-sugar to sweeten it. Put the paste in a pan over the fire, and mix with it half a pound of butter, which must be continually stirred into it. When the paste has become sufficiently stiff by boiling, make it into the shape of a hedge-hog. Imitate the bristles by means of blanched almonds slit, and place

the hedge-hog in a dish. Then boil some cream with sugar, and the yolks of a few eggs, and when ready, pour into the dish round the hedge-hog. Let the dish get cold, and send it to table.

Barley Sugar.—Prepare some strong syrup, and boil it as much as possible without allowing it to change color. Then strain into it a strong decoction of barley. Remove the syrup from the fire, and allow it to settle; then pour it out on a marble slab previously well oiled. When the barley sugar is cold, cut it in pieces, and roll it into sticks of the proper shape.

Lemon Drops.—Pour some lemon-juice on some finely-powdered loaf-sugar, and boil to the consistence of thick syrup. Drop this on plates, and put them in a warm place to dry. They are then to be taken off the plates, and preserved in well-stopped vessels. If preferred, some of the lemon-peel may be cut small and added to the syrup.

Another Way to Make Lemon Drops.—Pour four ounces of lemon-juice over a pound of loaf-sugar, and also the same quantity of rose-water. Boil them into syrup, and then add some grated lemon-peel, and mix them well together. Then proceed as previously directed.



Batik wall hangings. Step-by-step photographs below show how center one was done. Surprises include crackled effects, rich color-on-color overlays

Here's a first try at making your own batik

SUNSET NOVEMBER 1967

In **batik**—or wax painting—you draw or paint a design on cloth with molten wax, then dip the cloth in dye. The exposed areas take the dye, while the waxed areas retain the previous color of the cloth.

This ancient art, brought to a high degree of sophistication in Javanese textiles, is being adapted by some artists in the West to make decorative panels for wall hangings. Ann Bowns, of Sacramento, who designed most of those pictured here, suggests that beginners, children and adults both, try this simplified method first (with perhaps a preliminary experiment or two):

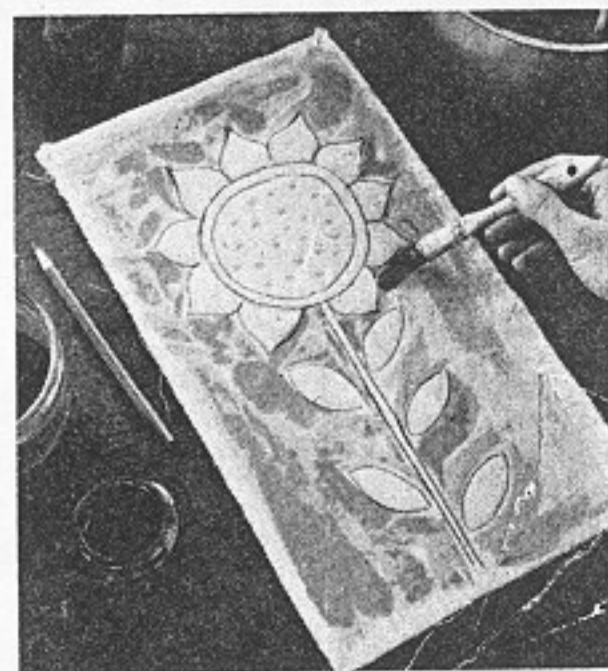
The base can be a piece of old sheeting or unbleached muslin; closely woven, thin fabrics are best. If the fabric is new, wash thoroughly to remove any sizing. You will also need: a box of paraffin wax; a small, inexpensive paintbrush to cover large areas with wax; a smaller pointed brush, such as a Japanese ink brush, for finer lines; several packets of ordinary fabric dye—you might start with gold, scarlet, royal blue; a non-waxy drawing tool such as chalk or charcoal; a good-



Tjanting is traditional tool used by Javanese for applying wax—you fill the bowl, apply wax with spout. It takes practice

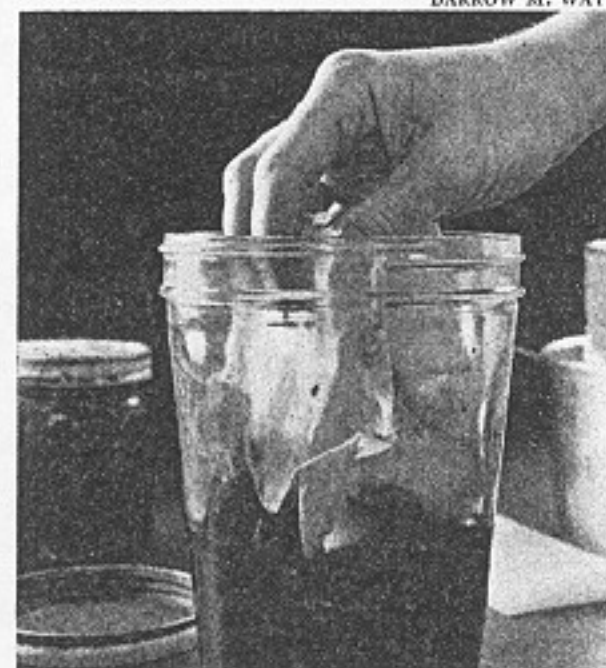
sized can in a pan of hot water, to melt wax; large glass jars or enamel pans for the dye baths; an electric iron; newspapers; perhaps rubber gloves for dyeing and old sheeting for straining the dye.

Draw your design on paper and transfer it to the sheeting with carbon paper; or draw it directly on the fabric with chalk or charcoal. If you're stumped for design ideas, leaf through magazines, children's coloring books, or old greeting cards. Work on a flat surface that won't be harmed by warm wax.

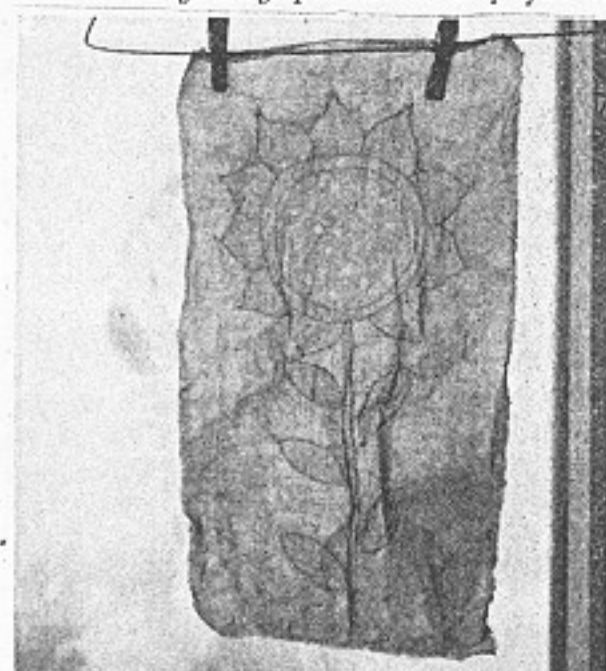


1. Brush molten wax on background, add daisy dots. Wax must penetrate fabric; reheat as needed to keep thin

DARROW M. WATT



2. Mix yellow dye (lightest color) in water (about 90° F.); strain to remove grainy particles. Dip fabric



3. Hang to drip dry; panel must be bone dry before rewaxing. Areas not covered with wax are now yellow

March, 1927

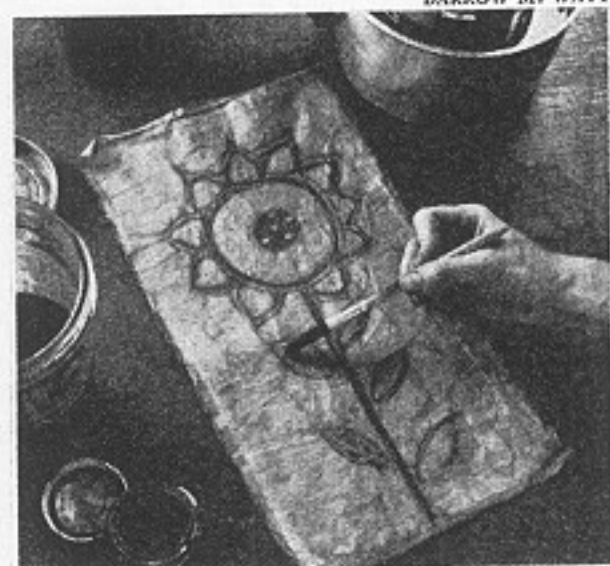
GREYHOUND AS COYOTE KILLER
HELPS PROTECT SHEEP

Trained greyhounds have been enlisted by western sheep raisers in the war against the coyote. Two of the dogs made a record in a few weeks last fall when they killed twenty-two of the marauders. Their speed enabled them to overtake the swift coyote and they learned how to work together, one dog grabbing the prey by a hind leg while the other sprang at its throat. In severe winters especially, the coyote does great damage to the flocks and it is a menace to poultry the year around. The government and the states co-operate in efforts to exterminate the animals. Professional hunters and poisoners are employed, and in most western states a bounty is given for a coyote scalp. At certain times of the year, the pelt is valuable for fur. The use of greyhounds is considered unusual, for although the dogs were known to be faster than the coyote, many did not believe that they would be a match for the brutes when cornered, for then the coyote, generally a coward, is a savage fighter.



4. Apply second wax coat in all areas to remain yellow—part of blossom, center of leaves. Mix red, dip fabric

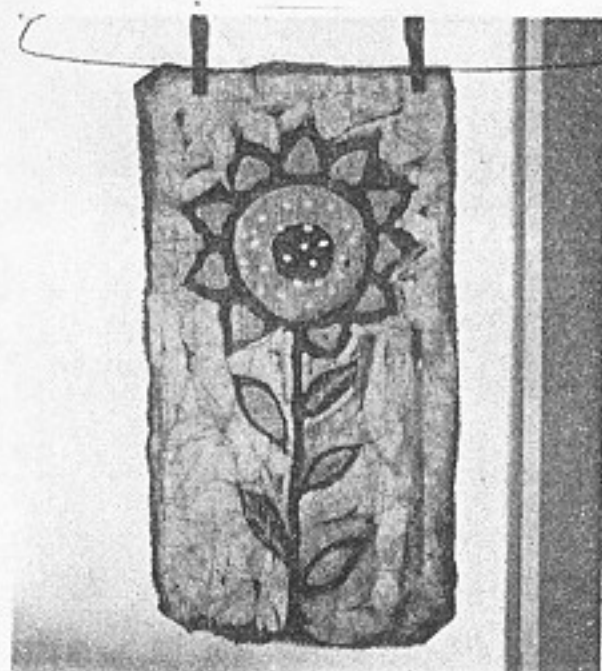
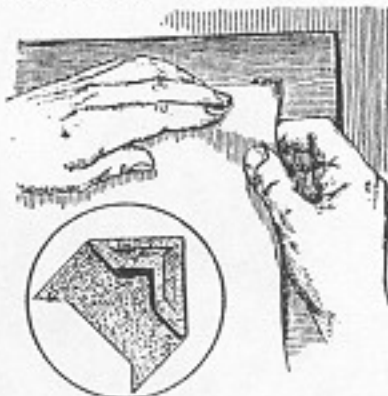
DARROW M. WATT



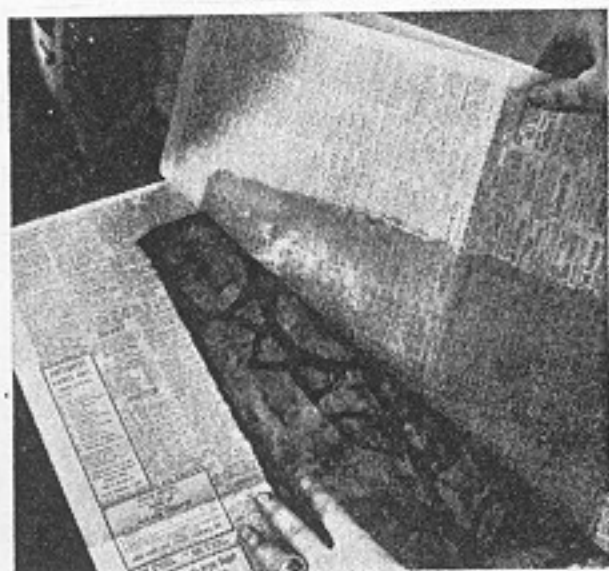
6. Apply third coat of wax to all areas where you don't want blue dye to appear. Mix blue and redip fabric

Art-Mounting Corners Used to Hold
Drawing Paper

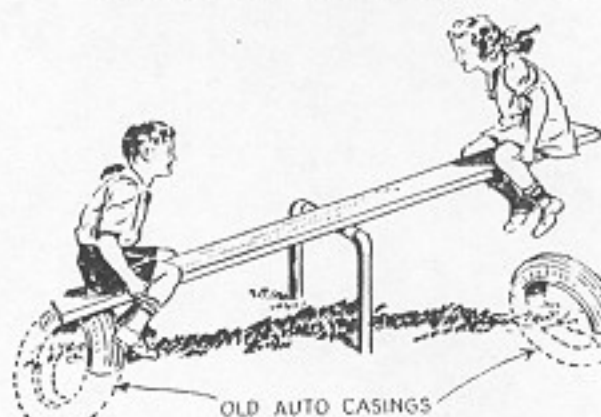
Instead of using thumbtacks for fastening drawing paper to the board, art-mounting corners will be found handy if the sheets of drawing paper used are all of the same size. Glue four of these corners to the drawing board, and it will then be a quick and easy matter to remove and replace the paper. It has been found possible to use one set of corners for fifty sheets of paper. They lie flat and do not interfere with the use of the T-square or triangles any more than the usual thumbtacks.—Walter W. Mallett, Olympia, Wash.



5. Dry again thoroughly. Red dye over yellow produces rich orange outline around petals, leaves, daisy center



7. Place wet fabric between newspaper (avoid heavily inked pages); iron with hot iron; repeat until wax is removed

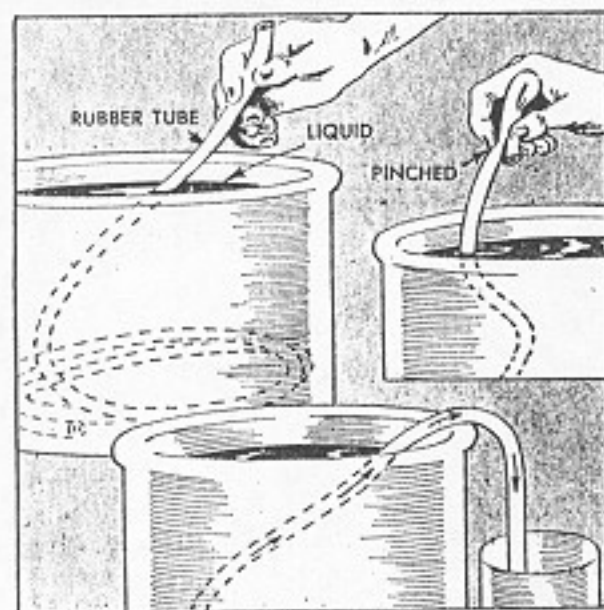
POPULAR MECHANICS
March, 1939Auto-Casing Bumpers on Seesaw
Protect Children's Legs

As an aid in sitting on a seesaw, children often bring their legs well under it with the result that they are sometimes injured when the ends of the seesaw strike the ground. To avoid this, an old auto casing can be set into the ground under each end of the board at an angle as indicated. The casings also absorb the shock.

Popular Mechanics 1947

Easy Way to Start a Syphon

A simple and safe way of starting a syphon, especially when handling caustic, poisonous and other dangerous liquids, is shown in these three steps. First, insert the syphon tube in the liquid almost to the end to fill it with the liquid. Fold over the end and pinch it tightly together to prevent entrance of air. Then, still keeping the tube



pinched tightly, lower the end outside the container below the level of the liquid inside, release the pinched end and the syphon will start.

Jack Bronte, Nevada City, Calif.

CHROMIUM PLATING

Simplified

POPULAR MECHANICS

AUGUST, 1940

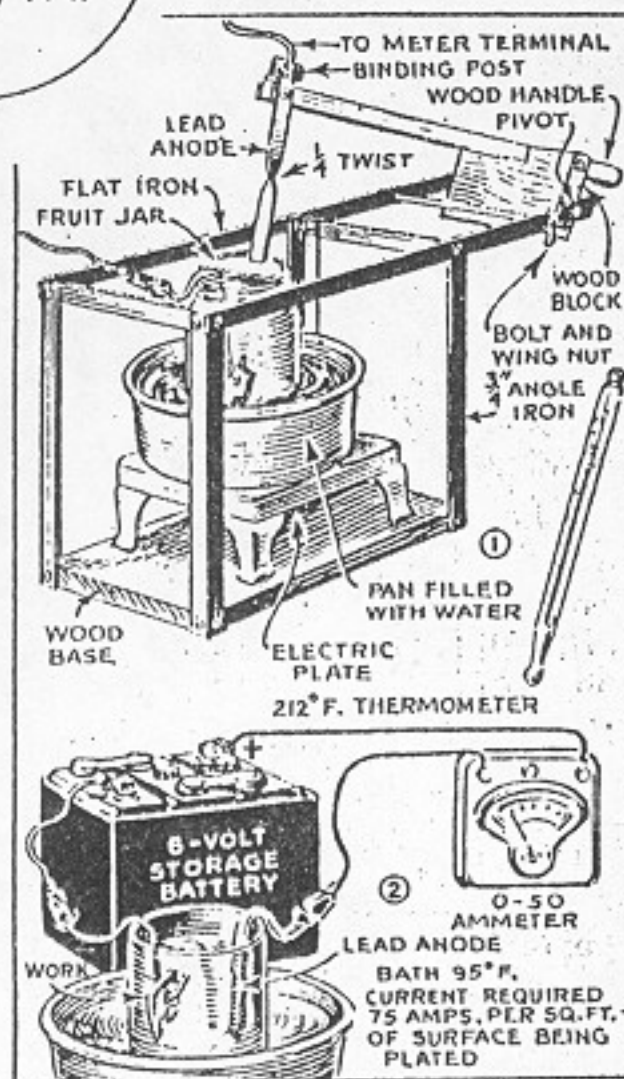
Lever to immerse anode in the plating solution gives accurate current control

By Alexander Maxwell

WHERE an exceptionally hard surface is needed for wear-resisting quality, such as cutting edges of tools, chromium plating with subsequent honing has been found highly successful. Compared to a diamond, which for the sake of comparison we will rate at a hardness of ten, and tool steel, which ranges from four to seven, chromium is about nine. Applied directly to steel, it enables a tool to be used about four times as long as normally possible before sharpening.

A convenient chromium-plating arrangement for small work is shown in Figs. 1 and 2. A wood or metal framework on a wood base holds a gas or electric plate for heating a pan or pail of water in which a glass or stone container is set. The latter contains the plating solution, which is kept at uniform temperature by the hot water. Spacing blocks are provided under the jar to avoid direct contact with the pan. The framework also supports an anode holder, which is pivoted so that the anode can be immersed slowly into the plating solution until the correct current flow is registered on a 0-50 ammeter. When the anode, which is lead, has been immersed as far as required, the anode handle is locked in position by turning a wing nut on the frame until plating has been completed. Where considerable plating is done, a switch controlled by a thermostat in the water bath has been found helpful in turning the elec-

CHROMIUM-
PLATING SOLUTION
CHROMIC ACID, 9 OZ.
SULPHURIC ACID, .07 OZ.
WATER, 1 PT.





tric plate on and off to maintain uniform temperature automatically. While plating, the solution gasses violently and the fumes produced should not be inhaled as they are injurious to the nose and throat lining. To avoid this, a fan is placed between the operator and the tank to blow the fumes away through an open window. Fan-equipped exhaust hoods are also used. An additional precaution to prevent injury from breathing the fumes is to rub vaseline inside the nose, especially on lengthy plating jobs. Rubber gloves are worn when handling the work or any other time when there is a possibility of getting the plating or rust-removing solution on the hands. However, if the worker accidentally gets some on his hands, immediate rinsing in running water will prevent any harm.

Rust on the work to be plated should be removed, although scrupulous cleaning

CURRENT REQUIREMENTS FOR SURFACE AREA

(at 75 amps. per sq. ft.)

1 sq. in. requires	0.52 amp.
2	1.04
3	1.56
4	2.08
5	2.6
6	3.12
7	3.64
8	4.16
9	4.68
10	5.2
20	10.4
30	15.6
40	20.8
50	26.0
60	31.2
70	36.4
80	41.6
90	46.8
100	50.2

④

procedure necessary with most plating baths is not essential with chromium, as the acid itself is better than any soap or solvent available. For rust removal a bath of hydrochloric acid and water (see formula

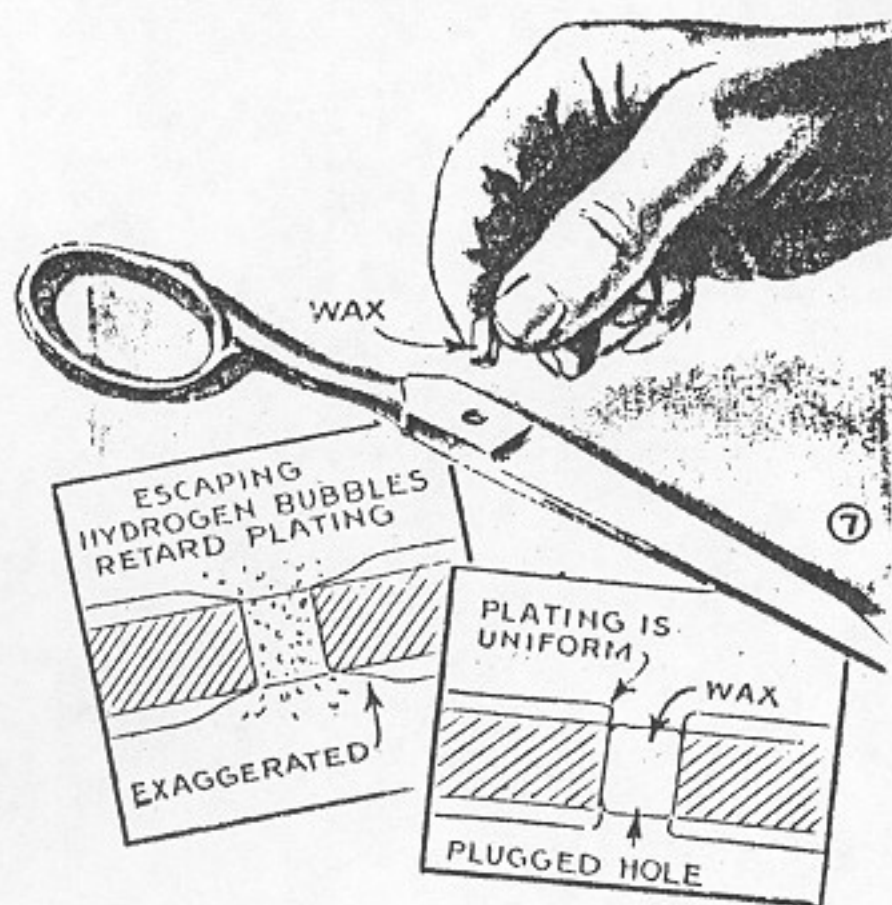
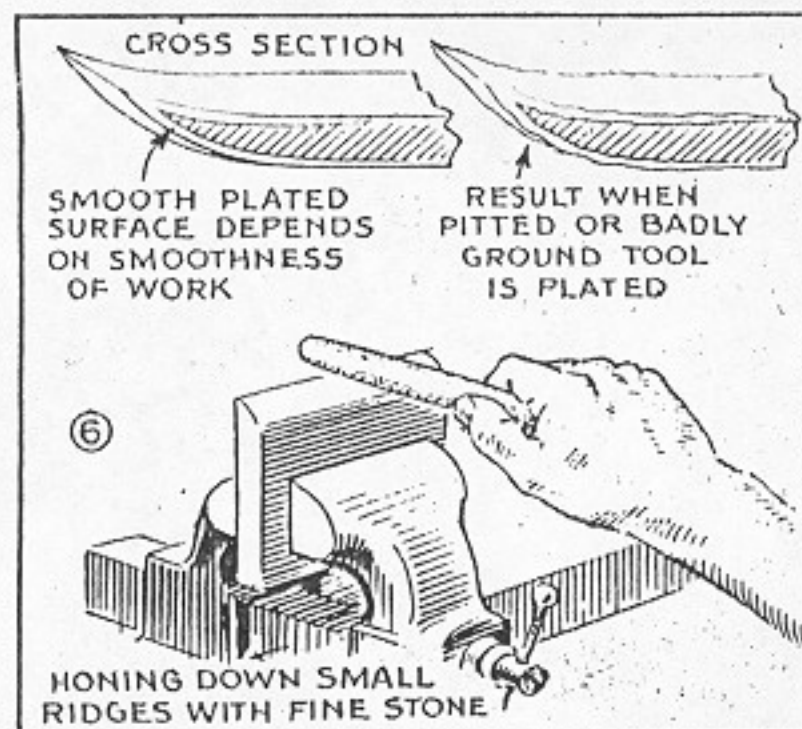
under Fig. 5) is prepared, and this is heated in a pan of water to a temperature of 120° F., after which the rusty objects are immersed. Light coatings of rust are dissolved in about 10 minutes, but an hour or so may be necessary for bad cases. Then scrub and rinse well with water.

The smoothness of the plated surface varies with that of the surface underneath as shown in Fig. 6. Therefore surface irregularities of the work are removed before plating it. Preliminary smoothing of a rough surface is accomplished by grinding with suitable stones. This is followed by a thorough buffing, Fig. 8, using a cotton buff charged with fine silicon carbide in lard, then tripoli. For final polish a high-speed flannel buff charged with rottenstone is used. Holes, such as those in a pair of pliers or scissors, resist plating because the hydrogen generated is sufficient to drive chromium away from surrounding surfaces. These holes are plugged with wax, plastic clay or cork as in Fig. 7.

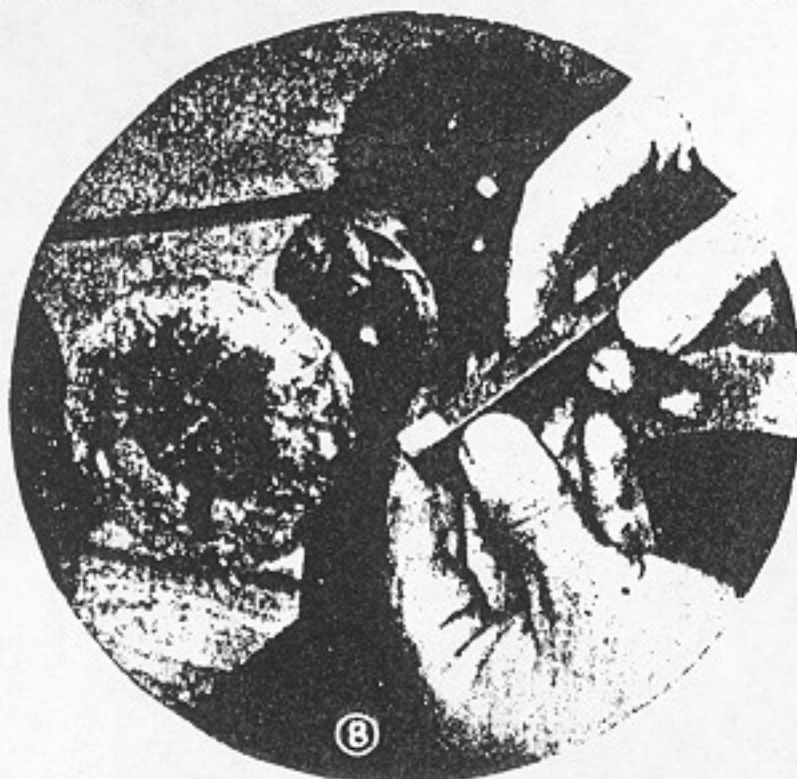
Successful chromium plating depends on keeping the sulphate percentage of the solution within bonds, keeping the temperature of the solution constant at 95° F., and applying the proper amount of current, which is 75 amps. per square foot of surface being plated. An effective plating so-

lution is given at the left of Fig. 1. The chemicals must be proportioned carefully as indicated in Fig. 3. Commercial chromic acid has a light amount of sulphate in it and usually requires the addition of a small amount of sulphuric acid with a medicine dropper. When the correct amount of sulphate is present, a bright deposit of chromium will be produced at a temperature of 95°, provided the correct amperage is applied. To test, add sulphuric acid drop by drop while plating a sample piece. The table given in Fig. 4 shows exact current requirements for various areas from 1 to 100 sq. in. Current is supplied by a 6-volt, heavy-duty storage battery. The negative side is connected to the work and the positive side runs through the ammeter to the anode, as shown in Figs. 1 and 2. Use heavy rubber-covered wire or flexible cable of large enough size so that it will not heat excessively when a large current is passed. If any one or more of the three factors controlling the success of the work are at fault, the plate deposited will be milky, flaky or muddy. The first 5 seconds determines the type of deposit, but it usually takes about 20 minutes to build it up to satisfactory thickness. If the deposit at first is not right, it can be removed from the work by immersing in the warm rust-removing solution.

Odd-shaped pieces of work require specially shaped anodes because the chromium is deposited first and most on parts of the work closest to the anode, and may skip those farthest away. A number of methods for spacing the surface of the anode equidistantly from the surface of the work, are given in Fig. 9. Uniformly curved surfaces such as reflectors are rotated a few degrees every minute to obtain uniform plating. In lining a bronze or steel bearing, the anode is a lead rod located in the exact center of the bearing. The entire jig is dipped into the solution and is kept in constant motion while plating. The current flow is determined by the area of lead immersed, and experiments are first made in order to determine the proper diameter needed for giving the correct amperage for the area of work. When large surfaces are to be plated, the heavy current required makes it necessary to have good contacts between the work and wire from the battery. Wherever possible the wire is sol-

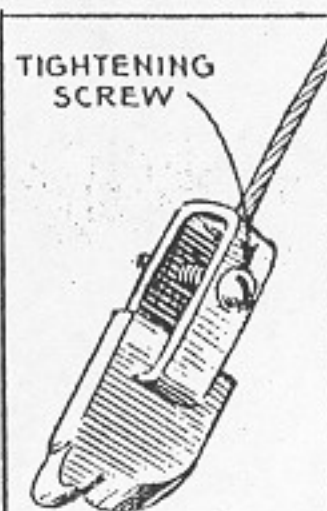
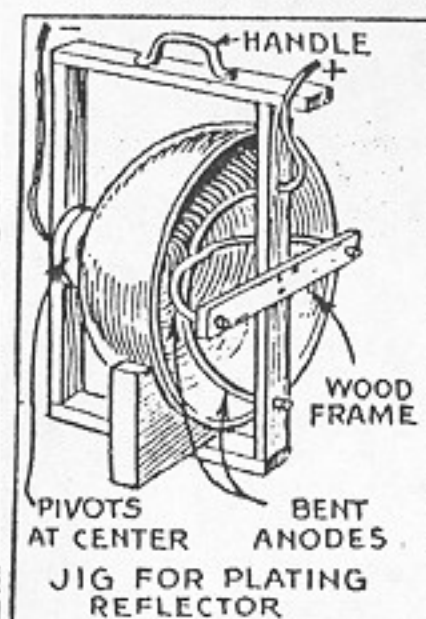
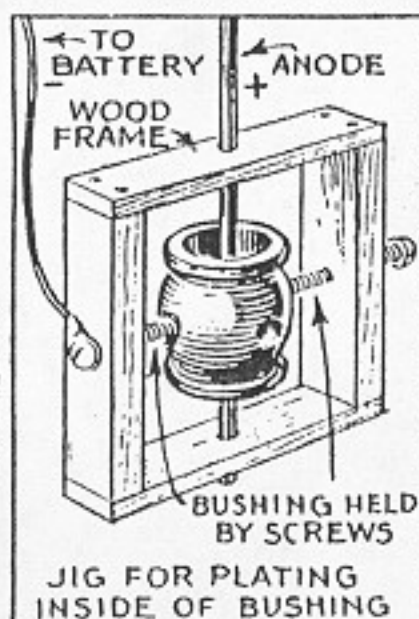


dered to the work; otherwise a strong spring-type clip is used, which is shifted in position during plating to avoid unplated spots. The area of the clip should be added to that of the work to get correct figure for current. Statuettes and ornaments are best plated in a dilute plating solution. Start them at lower current than the maximum given in the table and increase the current gradually to maximum as the plating progresses. Objects having irregular surfaces not sufficiently pronounced to require specially shaped anodes should be kept moving constantly in the plating bath to assure an even coating of chromium all around. In order to plate metals other than steel, copper or nickel, they must be copper or nickel plated be-

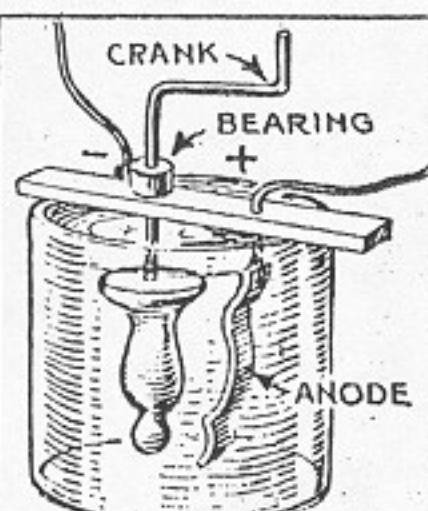


Tools to be plated must be free from rust, pits and scratches if a smooth coating of chromium is expected. If necessary, grind down the tool and polish to a mirror-like surface

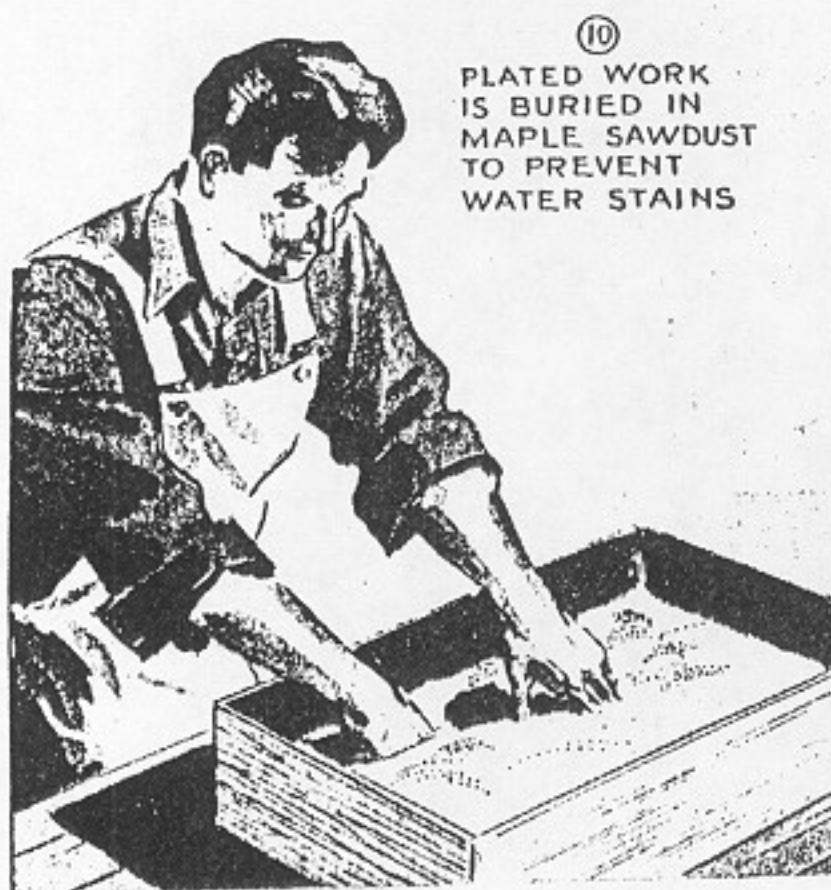
⑨ IRREGULAR WORK REQUIRES SPECIALLY SHAPED ANODES



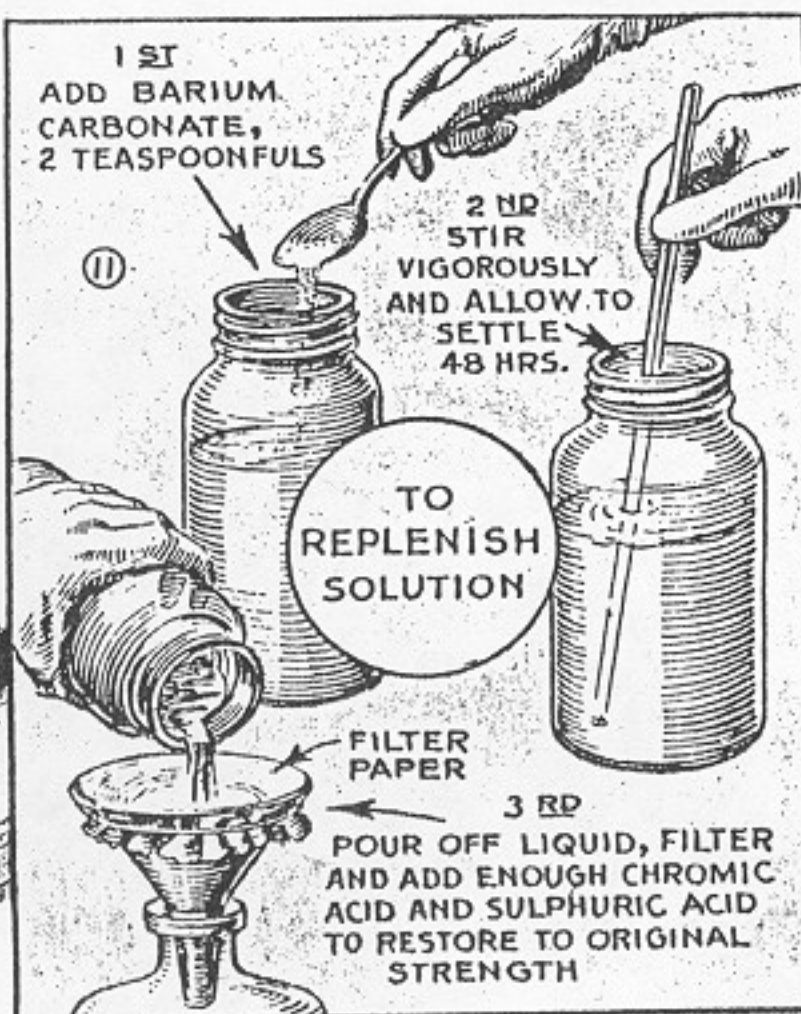
STEEL CLAMP TO HOLD SMALL OBJECTS



IRREGULAR OBJECT ROTATED; ANODE BENT TO CONFORM



⑩ PLATED WORK IS BURIED IN MAPLE SAWDUST TO PREVENT WATER STAINS



fore applying chromium. For cutting and abrasion resistance on tools, a .005-in. plate is sufficient. When plating tools, allowance is made for grinding down the surface to a keen edge, and for this reason an extra thick deposit is made. When work has been given a plate of sufficient thickness, it is washed in running water and is buried in maple sawdust, which dries it and prevents the formation of water spots. See Fig. 10. After using chromium-plating so-

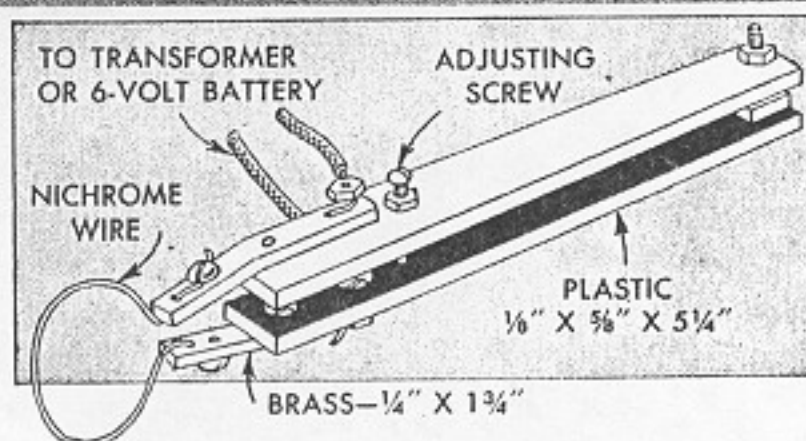
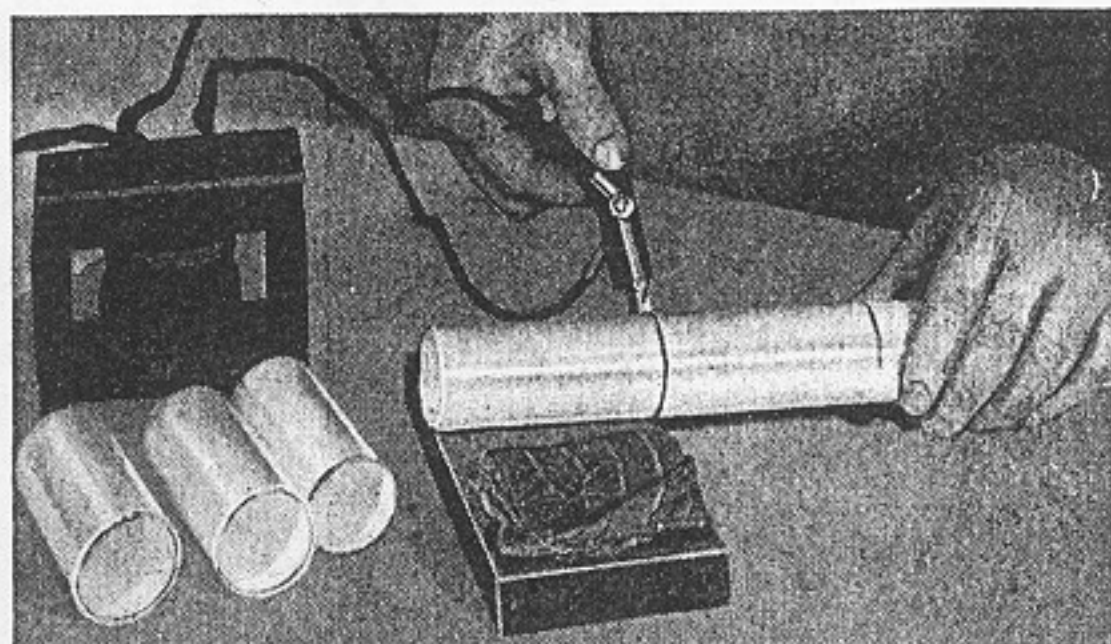
lution, its sulphate content increases and the quality of the work decreases correspondingly, but the addition of barium carbonate to the solution, as shown in Fig. 11, neutralizes the sulphate. This is stirred in and allowed to settle, after which the clear liquid is poured off and filtered. More chromic and a slight amount of sulphuric acid are added to restore the solution to original strength.

Popular Mechanics 1949

Electrically Heated Wire Will Cut Glass Tubing

With a cutter like this one, which consists of a loop of electrically heated Nichrome wire fitted to a plierlike holder of hardwood or plastic, you can cut a number of lengths of glass tubing quickly. The resistance wire is taken from an electric iron, coil heater or a similar appliance. Power is supplied by a 6-volt storage battery or a toy transformer of 10-ampere capacity. In use, the loop is slipped over the tubing and pressed firmly against the glass, then current is applied for 4 or 5 seconds, after which the tube is touched to a wet cloth, causing it to break because of the sudden change in temperature. Prolonged contact with the hot wire will overheat the glass and cause it to melt.

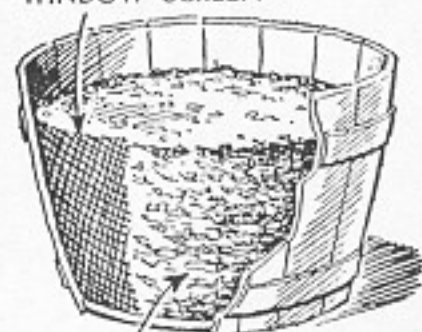
Sam Brown, Marion, Ohio.



Popular Mechanics, 1951

Raise Your Own Bait Worms

WINDOW SCREEN



MIXTURE OF
LEAF MOLD AND SOIL

knot holes, line it with window-screen wire and then fill it with a mixture consisting of equal parts of leaf mold and rich, loamy soil. A farm the size of a half barrel will

A plentiful supply of bait worms will be available even in dry weather when they are hard to find, if you start a worm farm in a wooden box or half of a barrel. If the container has large cracks or

accommodate about 300 worms. Dig them from rich garden soil, if possible, and place them on top of the earth in the barrel. The healthy worms will soon dig themselves into the soil, those that have been injured remaining on top. The latter should be removed and discarded. Keep the soil damp, but not too wet and store the barrel in a cool place. Baby-chick meal boiled for about 10 min. is an excellent food for the worm farm. When cool, this should be placed just below the surface of the soil. The worms are fed only once a week, and the uneaten food removed after 24 hours, as it otherwise will rot and cause the soil to become sour.

Dip and dye Easter eggs

SUNSET APRIL 1969

You block out the design on these Easter eggs with masking tape, then dip them in dye. The resulting patterns are crisp and clear, with just enough variation to give them a handcrafted look. The process resembles that of batik except masking tape is used to resist the dye instead of wax.

Use hard-boiled eggs or, if you plan to keep them, blown eggs. (To blow an egg, prick a hole in each end, one slightly larger than the other; break the yoke with a needle and blow the egg through the larger hole. Rinse with clear water.)

Before you apply the design and dye the eggs, bring them to room temperature. Handle them as little as possible to avoid getting oil from your hands on them, because it may reject the dye.

Cut pieces of design from masking tape. Keep the shapes simple—squares, triangles, stripes, and spots are good shapes for beginners. Make a collection of them ahead of time; attach them lightly to a glass dish to keep them sorted and ready for use.

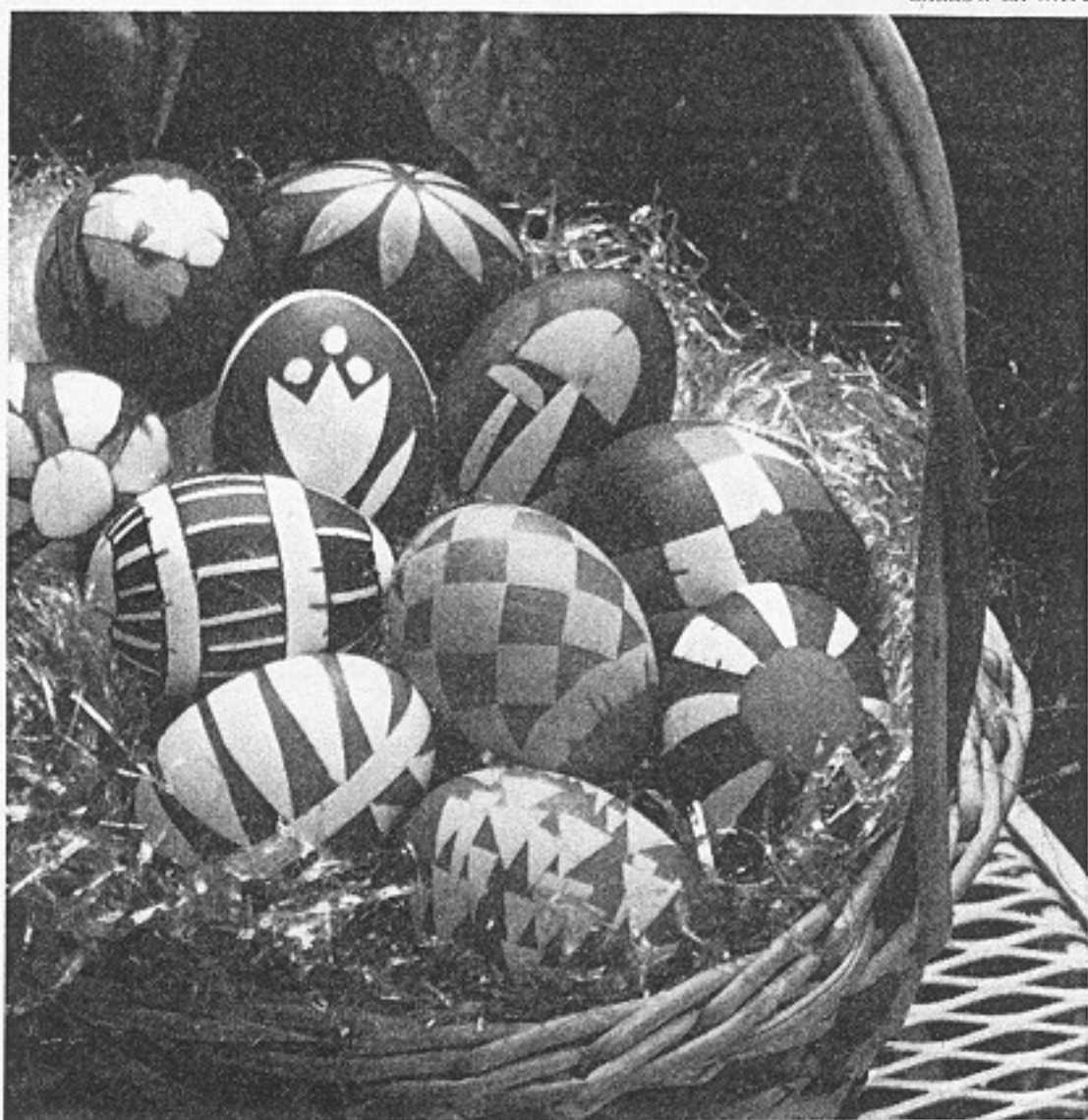
Stick the design shapes firmly on each egg; use the flat of a fingernail to smooth and press the edges down securely and flatten any wrinkles.

Mix packaged Easter egg dyes according to the instructions (or use food coloring), then dye the egg any desired color or shade. If a pattern calls for more than one color, let the egg dry thoroughly, then apply the design pieces where you want to preserve the last color and dye the egg again. Work from light to dark colors. When the design is finished, blot the egg carefully with paper towels and remove the tape.

You can also work designs in reverse: Put all the design pieces on at the beginning; dye the egg in a dark background color; let it dry; then remove pieces of the design and dip again in a second lighter color. You can repeat this until all the tape has been removed.

Sometimes the third or fourth dye bath will start to remove a former color; this can produce some unusual effects.

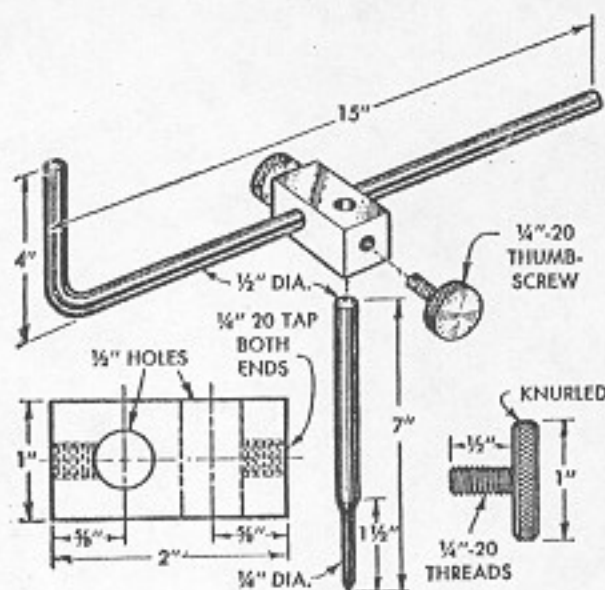
For an antiqued effect, use a rough rag to rub off the dye in the open spaces before you remove the tape, leaving color around the edges of the tape. Then dye the egg in a different, lighter color.



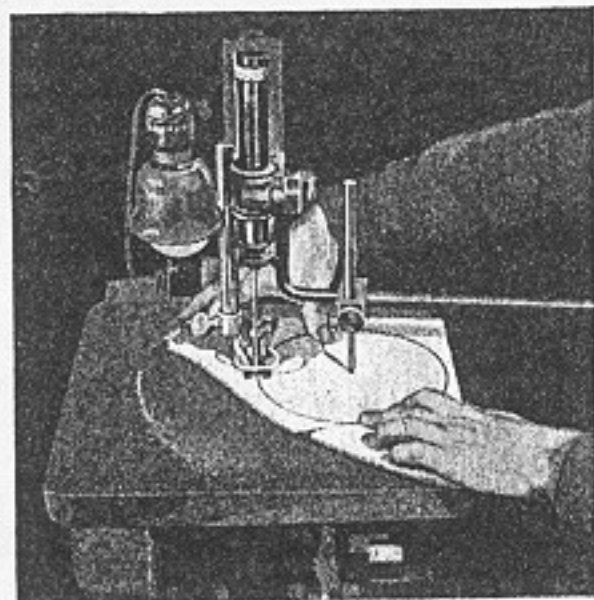
Crisp designs on these eggs were masked out with tape before eggs were dyed

Popular Mechanics 1949

Accurate Circles Are Cut With Jigsaw Fixture



When one or a number of duplicate circles are to be cut on a jigsaw, the work can be done quickly and accurately by using this simple fixture or circle cutter. Only parts required are a length of rod to form the guide arm, another length for the center pivot, a metal block that slides on the guide arm to serve as a holder for the pivot, and two thumbscrews to adjust the holder. The detail gives dimensions for the parts and the method of assembly. In use, the guide arm is locked in the hold-down

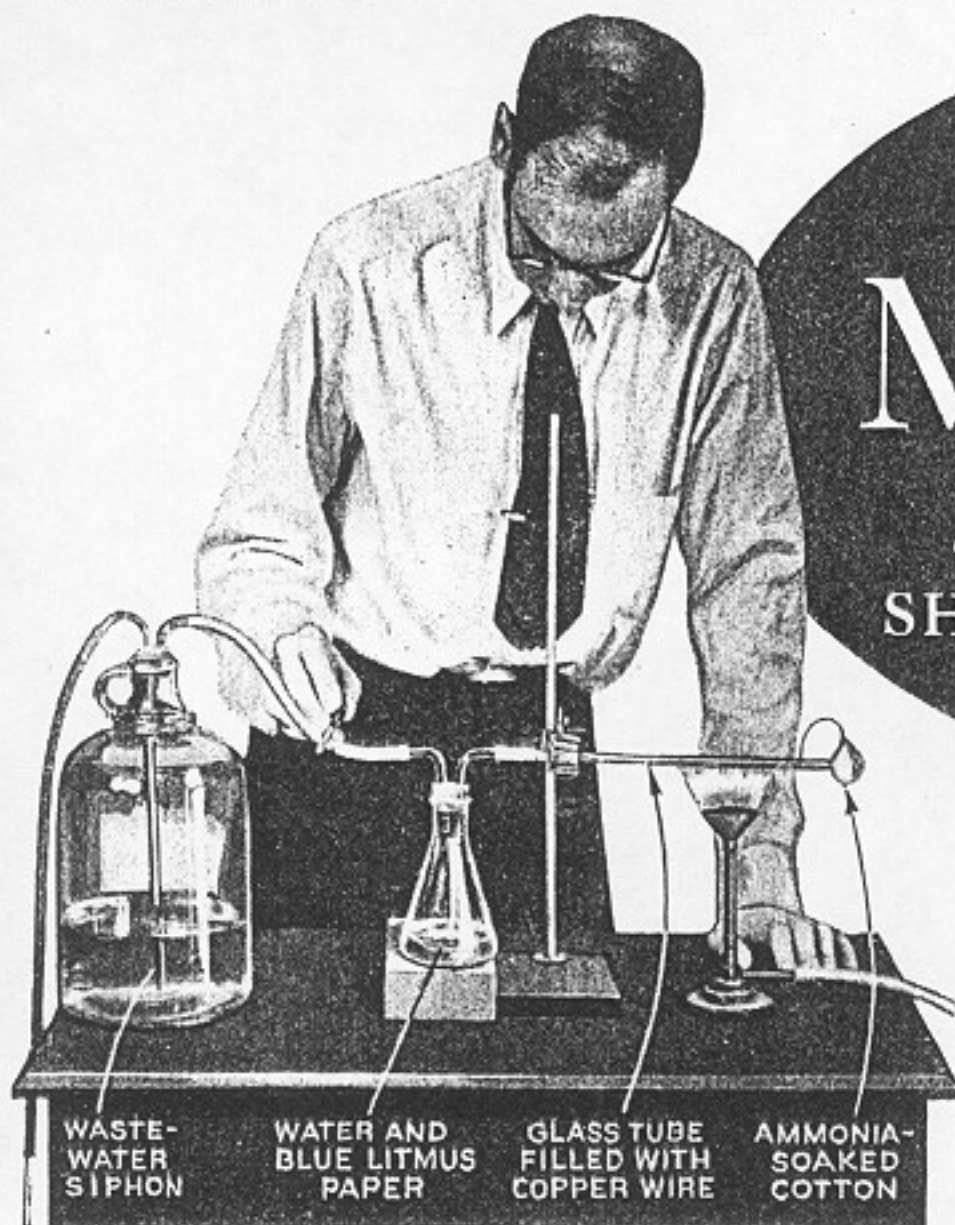


bracket at the end of the jigsaw arm and the pivot point is set at the desired distance from the saw blade (the radius of the circle); then the point is clamped down on the work and the piece is rotated. To cut an outside circle, advance the work until the cut is tangent to the circumference; clamp the pivot in place and use the fixture to complete the circle. For an inside cut, drill a hole inside the circle, insert the saw and run the cut to the circumference.

D. J. Bachner, Jackson Heights, N. Y.

Chemical Matchmakers

...HOME EXPERIMENTS
SHOW STRANGE BEHAVIOR
OF CATALYSTS



WASTE-
WATER
SIPHON

WATER AND
BLUE LITMUS
PAPER

GLASS TUBE
FILLED WITH
COPPER WIRE

AMMONIA-
SOAKED
COTTON

COPPER AS A CATALYST. When a mixture of ammonia vapor and air is passed over hot copper filings, in this experiment, ammonia is oxidized and the product dissolves in water to form nitric acid

POPULAR SCIENCE MONTHLY

MAY, 1937

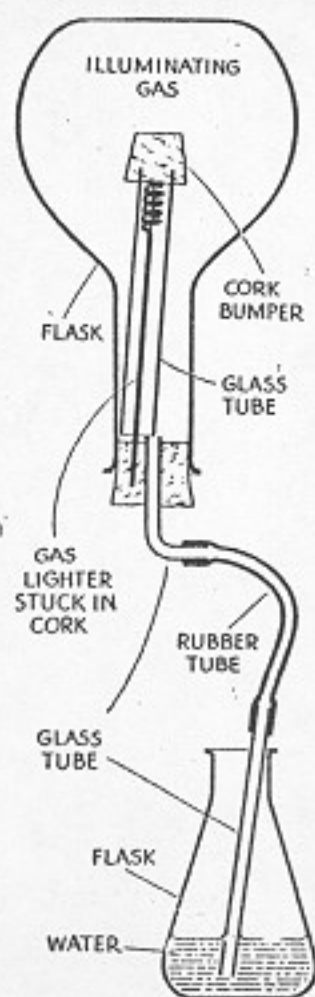
ONE of the simplest-looking, yet most mystifying, of kitchen utensils is the "fireless" gas lighter. Turn on the gas, poke this handy little device above the burner, and a tiny wire glows red-hot. Presto—the gas lights. What makes the thing work?

The answer is that it contains a "catalyst"—one of a large group of substances whose curious behavior you will enjoy investigating in your home laboratory. All have the strange power of assisting other chemicals to interact, merely by their presence, without entering into the reaction themselves. You might call them chemical go-betweens or matchmakers. Because certain reactions will not occur without their help, catalysts play a vital role in modern industry. Great quantities of sulphuric acid, for example, are made with their aid—and it has been said that the advancement of a nation can be measured by its consumption of sulphuric acid, so useful and necessary is this chemical to our daily needs.

Not only does the humble gas lighter represent one of the most familiar applications of catalysts, but it also affords a good starting point for home experiments with them. If your household lacks such a lighter, you can pick one up at small cost wherever kitchen utensils are sold.

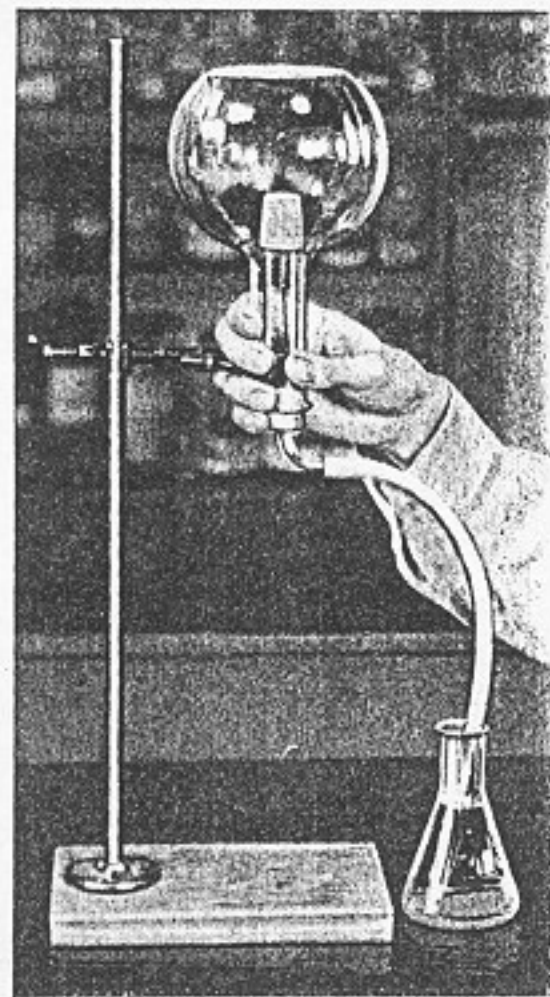
Avoid the striking or sparking variety; the kind you want has no mechanical action, but simply contains a delicate wire within a protecting spiral guard.

Mount a lighter of this type above the wick of an unlighted alcohol lamp, and you will see the wire begin to glow. As it does so, it radiates heat that continually volatilizes more alcohol. If the wire is shielded from chilling drafts, it will remain



How a Gas Lighter "Adsorbs" Gas

When the large flask is turned right side up, the "fireless" gas lighter is exposed to the illuminating gas. Water is drawn up into the glass tube at the bottom of the apparatus, showing that the rare metal in the lighter is "adsorbing" the gas



red-hot for several hours. You can improvise a shield by breaking out or cutting off the bottom of a test tube and using the remaining section as a glass chimney. Do not fit it down snugly over the lamp, but leave a small opening near the

wick to allow air currents to enter and carry the alcohol fumes past the wire of the lighter.

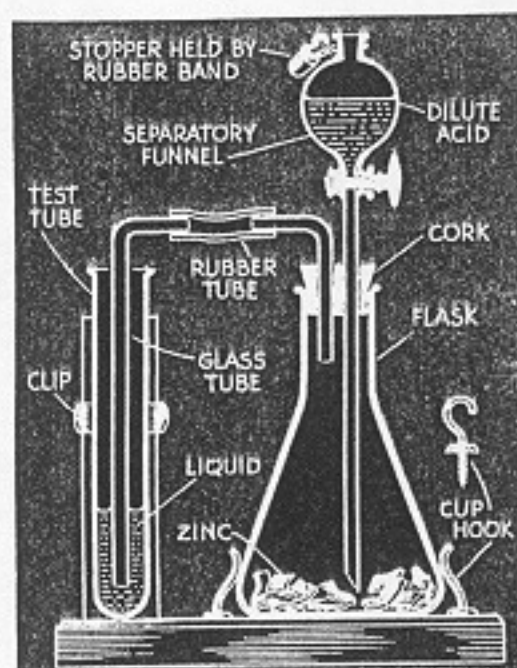
This active part, which serves as a catalyst, is a wire carrying a bit of platinum or palladium black—a finely divided form of platinum or palladium metal. Its presence enables the alcohol vapor to combine with the oxygen of the air, even in the cold. The reaction liberates enough heat to raise the wire to glowing temperature.

Similarly, when you hold the lighter over an opened gas burner, the platinum catalyst promotes a reaction between the gas and the surrounding oxygen, and the wire glows with the resulting heat. In this case, the temperature of the glowing wire is high enough to ignite the gas.

Lower your gas lighter into the upper part of a flask containing a strong solution of ammonia water (ammonium hydroxide). Again its wire will glow. In this case, it is the ammonia vapor that is oxidized, or aided to combine with the oxygen of the air, by the catalyst. If the gas lighter refuses to work after a while, it can be "activated" or restored to service by holding it in a blue flame to burn out impurities.

Plain platinum wire can be substituted for the gas lighter as a catalyst in this experiment. A small length—about two inches or so—can be obtained from a chemical supply house for considerably less than a dollar. If you have such a piece, coil it into a little spiral, heat it red-hot in a Bunsen flame, and quickly lower it into the flask of ammonium hydroxide. Suspended above the liquid, it will glow for many minutes.

Observing "New-Born" Hydrogen



Hydrogen gas can be manufactured conveniently for the test of its properties in the nascent state, and for other home-laboratory experiments, with this simple apparatus.

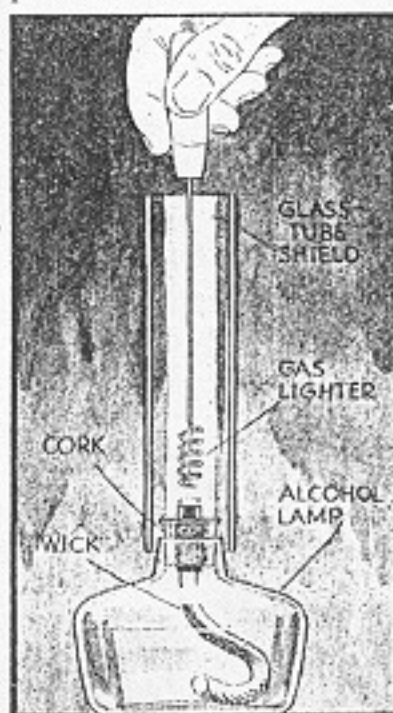
The ability of rare metals such as platinum to "adsorb" gases, or hold them adhering to its surface, seems to play an important part in the metals' behavior as catalysts. So marked is this power when

the metal is finely divided, as in the specially prepared form used in gas lighters, that huge quantities of gas can be adsorbed. If you expose a lighter to illuminating gas in a closed system, such as a stoppered flask, you can actually observe the removal of a part of the gas.

Fix the gas lighter to the inner side of a one-hole cork, fitted with rubber tubing leading to a glass tip that dips into a beaker of water. Cover the lighter with a glass tube, closed with a cork and fitting loosely. Now thrust the cork with its attachments into the mouth of an inverted flask that you have filled with illuminating gas.

This tricky little arrangement permits you to expose the lighter to the gas, when you are ready, simply by turning the flask right side up. The tube falls off, its cork acting as a bumper to avoid cracking the flask; and the illuminating gas comes in contact with the rare metal in the lighter, which adsorbs it.

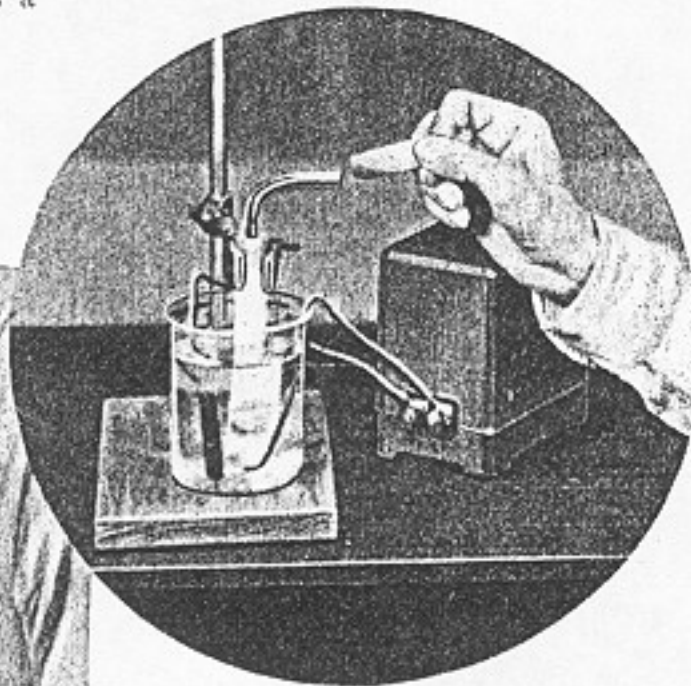
Watch the tubing that dips into the beaker. You will see water rising in it, perhaps as much as several inches, as a



A gas lighter mounted above the wick of an unlighted alcohol lamp, inside a glass shield, will glow for hours.

result of the partial vacuum produced in the flask by adsorption. This is the more striking when you recall that heat is generated by placing the lighter in the gas, which would tend to make the gas expand instead of shrink. If the heating effect were absent, therefore, the loss in volume of gas produced by adsorption would be considerably greater.

Costly metals are not the only ones



Passing an electric current through a dilute acid produces hydrogen which, in its "new-born" condition, reacts with sulphur to form hydrogen sulphide gas, which is detected by its effect on paper moistened with lead acetate solution.

that show "catalytic" properties. While German chemists used platinum in developing a large-scale wartime method of making nitric acid from ammonia, you

can duplicate the process with ordinary copper as the catalyst. The method consists of oxidizing the ammonia, as in experiments already described in this article; and then absorbing the resulting oxides of nitrogen, in water, to obtain dilute nitric acid.

Place some copper filings, or three or four strands of copper wire, in a piece of glass tubing ten to twelve inches long. Mount the tubing horizontally, with the aid of a split cork and a laboratory support, so that the copper can be heated with a fishtail burner, or a Bunsen burner equipped with a flame-spreading attachment. At the mouth of the tubing, suspend a small wad of absorbent cotton moistened with ammonia water.

The rest of the apparatus consists simply of a flask or bottle containing about an inch of water and one or two pieces of blue litmus paper, to catch and test the product of the reaction; and a suction attachment to draw the ammonia vapor through this set-up. As shown in one of the diagrams, the glass tubing first leads to the bottom of the collecting flask. A second section of tubing connects the top of the flask with the top of a gallon jug of water, which serves as the suction pump. A final length of tubing, running from the bottom of the jug to a lower level outside, acts as a siphon.

Start the water flowing, by sucking on the siphon tube, and air and ammonia vapor will be drawn in through the glass tubing containing the copper. The air-ammonia mixture then bubbles through the water in the flask. By using a pinch clamp between the flask and the suction jug, the flow of gases may be controlled and kept constant at about two or three bubbles a second. Meanwhile, the glass tubing that holds the copper should be kept heated nearly to its softening point.

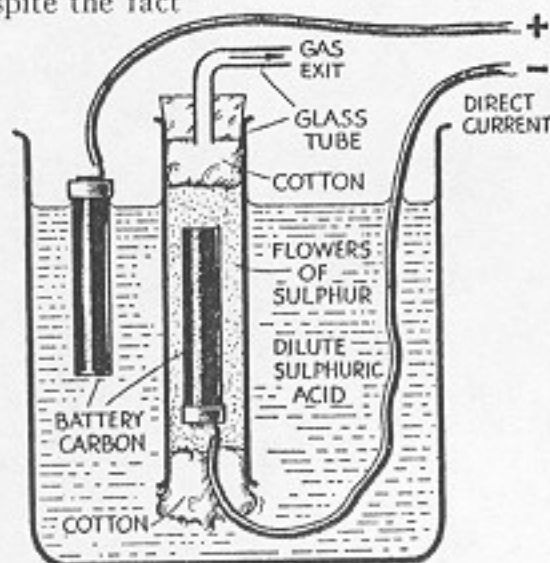
Acting as a catalyst, the heated copper unites the oxygen from the air with the ammonia and produces an oxide of nitrogen. This, in turn, dissolves in the water in the flask to form nitric acid. In consequence, you will see the litmus paper in the flask change color from blue to red. Hydrogen from the ammonia also combines with the oxygen from the air, producing water, as evidenced by the dew that condenses in the cooler part of the glass tubing.

Try substituting manganese dioxide for

copper in this experiment. You will find that it also will work as a catalyst. It should be dried by heating it before use.

Just what is the explanation of the mysterious behavior of catalysts? One of the most interesting theories suggests that a substance such as hydrogen briefly forms an unstable chemical compound with the catalyst. When released from this compound, the hydrogen is in a more active form—called atomic, "nascent," or new-born—which reacts more readily than the familiar variety of hydrogen.

In none of your previous experiments, probably, have you encountered this curious new-born gas. When you make hydrogen gas by adding acid to a metal, what you get is a stream of hydrogen "molecules," each one composed of a lightly joined pair of still smaller "atoms" of hydrogen. But these atoms were not always Siamese twins. When they were born in the acid-metal reaction, they were separate individuals. In the fleeting instant before they paired off with one another to form molecules, the hydrogen was in the state known as "nascent," or new-born. You might be surprised if you could test its chemical properties while it was in this condition, for it behaves quite differently from ordinary hydrogen gas. And, fortunately, it is possible to make such tests, despite the fact



Set-up of a simple "electrolytic cell" for generating hydrogen gas in the presence of sulphur to observe its ability to react and form hydrogen sulphide while in the active, nascent state

that there is only the tiniest fraction of a second in which it can be done.

A handy hydrogen-gas generator for this and other experiments is easy to make from an Erlenmeyer flask of about 250-cubic-centimeter capacity, containing scraps of zinc or iron tacks or nails and fitted with a separatory funnel for admitting dilute sulphuric acid. An inverted "U" of glass tubing delivers the gas that is generated to a test tube containing the liquid to be experimented with. The set-up may be mounted conveniently upon a wooden base, as shown in an accompanying illustration. Three or four common screw hooks, bent straight and covered with short lengths of small rubber tubing, make fingers to hold the flask in place. The test tube is supported by a metal clamp, screwed to a little wooden post about one inch square. Thus, the whole apparatus is self-contained, is easily taken apart for cleaning, and—what is still more important—

will not topple and break. When you fill the funnel with dilute acid and admit the liquid slowly to the flask, a copious stream of hydrogen gas is generated.

IF YOU place a solution of ferric chloride in the test tube and let hydrogen gas bubble through it, no chemical reaction will occur. Nevertheless, hydrogen gas can be made to react with ferric chloride. This will happen if the hydrogen comes in contact with the chemical before the atoms of gas have had time to pair up—in other words, while the hydrogen is still "new-born." How can you catch the atoms in this instant? All you have to do is to add a few drops of the ferric chloride solution directly to the generating flask.

Now, when acid is added to the zinc as before, the ferric chloride is acted upon, because the hydrogen comes in contact with it at the precise moment that the gas is liberated. The new-born hydrogen reduces or transforms the ferric chloride to ferrous chloride.

To prove this, add several drops of potassium ferricyanide solution to each of the vessels containing ferric chloride that hydrogen gas has bubbled through—the test tube and the generating flask. In the latter alone, a blue precipitate forms. Known as Turnbull's blue, it provides a distinctive color test that readily distinguishes between ferric and ferrous compounds.

Passing an electric current through a dilute acid gives you another way of obtaining nascent or new-born hydrogen for your experiments. It

will enable you to show that in this active state, hydrogen reacts with sulphur and forms hydrogen sulphide gas. The product of the reaction can be detected by its odor or with lead acetate paper.

A simple "electrolytic cell" for this purpose can be made from a beaker, or glass tumbler, and a pair of carbons from old flashlight cells. Insert one of the carbon rods (with a wire attached) in a length of glass tubing about three quarters of an inch in diameter, such as a test tube with the bottom cut off. Wad one end of the tubing with absorbent cotton, insert the carbon rod, and pack the tubing with flowers of sulphur that you have previously ground or rubbed in a mortar with dilute sulphuric acid. When the tube is nearly filled, close the remaining opening with a second plug of absorbent cotton and a cork carrying a glass "L" tube, as one of the diagrams shows. Fill the beaker or tumbler with dilute sulphuric acid. Pouring strong sulphuric acid, slowly, into four times its volume of water gives a solution of the right strength for use in the mortar and the beaker, as well as in the hydrogen generator previously described.

To pass an electric current through the cell, connect the sulphur-packed carbon rod with the negative terminal of a storage battery, or of a battery of three dry cells connected in series. Connect the remaining carbon rod with the positive source of electric current, and lower this carbon into the beaker. Current now flows through the cell. At the enclosed carbon rod which serves as the negative electrode, hydrogen is liberated from the acid. It is in the "nascent" state and combines with the sulphur about it to form hydrogen sulphide. As the gas escapes from the exit tube, you can test it by holding a strip of paper, moistened with lead acetate solution, at the mouth of the tubing. A black spot of lead sulphide, forming upon the paper, identifies the hydrogen sulphide gas.

A BACK-YARD "BEACH" FOR SMALL CHILDREN

POPULAR SCIENCE 1936



COMPACT and complete, this back-yard summer resort for small children includes a wading pool, sand-box, and shelves on which to put away boats, pails, and beach balls. Removable awnings protect against sunburn and on cloudy days are stored beside the tiny "cottage."

General dimensions are given, but the size may be increased, if desired. Skids 9 ft. 6 in. long permit moving the "beach" from one spot to another.

The sand-box floor is tongue-and-groove material. For the tank, use $\frac{3}{4}$ by 10-in. boards with squared edges. Candle wicking is laid in marine glue along each edge before the next board is drawn up tight, and it is also used at the sides and corners, where triangular cleats are nailed or screwed down over the calking. Bear in mind that marine glue is not casein glue; each has its purpose and each is excellent for that purpose. A sketch shows how the candle wicking is laid.

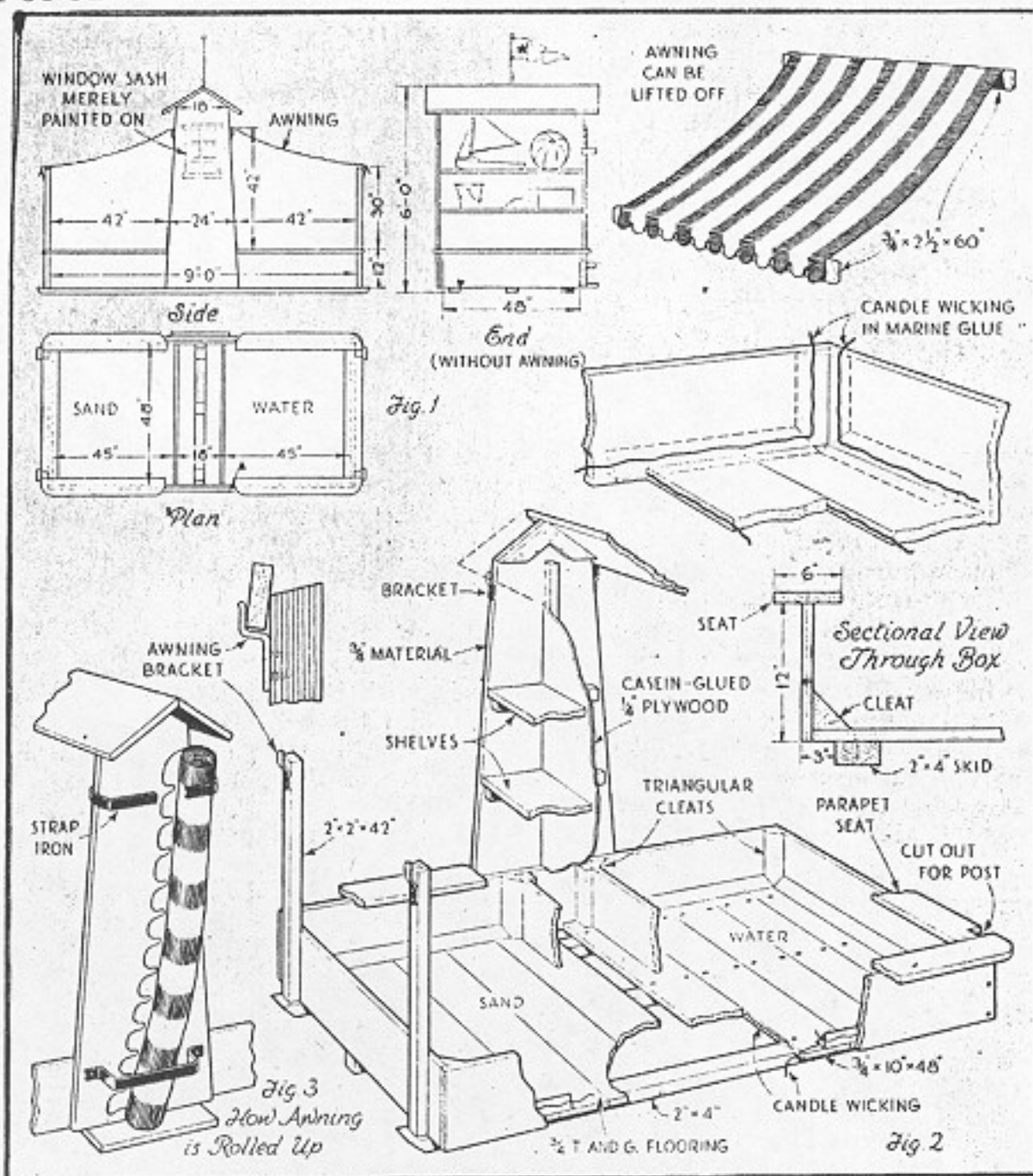
The central "cottage" is constructed as indicated in the cutaway perspective. The partition is important as it prevents water from being splashed over into the sand, and sand being tracked into the pool. Also, toys can be kept in order on the shelves.

All sharp corners and edges should be rounded. The hardware should be galvanized, or very thoroughly painted. Brass screws are best for the water tank. An ef-

fective paint combination would be a dark green exterior for the sand-box and pool; a lighter green for the cottage, with a red roof; and bright yellow for the inside.

A MONEY MAKING PROJECT FOR YOU

If you should gear up to build these, I guarantee you could sell one to every nursery school in your community.

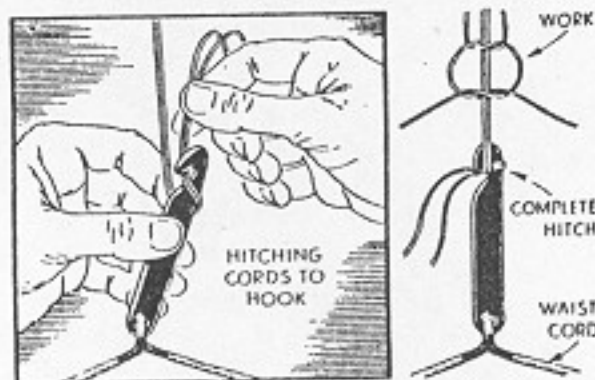


How the combination wading pool and sand-box is constructed, and suggested dimensions

SPECIAL HOOK SPEEDS UP KNOT WORK

THOSE readers who have become interested in square-knot work through the many articles on that subject by Kenneth Murray will find that a belt hook made as shown from an old toothbrush handle enables one to secure and cast off the "standing" cords much more quickly than is possible with the conventional type of wire hook. The notch can be made with a jackknife and file. The hook is fastened about the waist with a cord.

A little practice will enable one to secure the two cords upon which the knot is to be tied by means of a simple jam hitch, as illustrated. The hitch can be kept from slipping by leaning back slightly.—A. R. SAUNDERS.

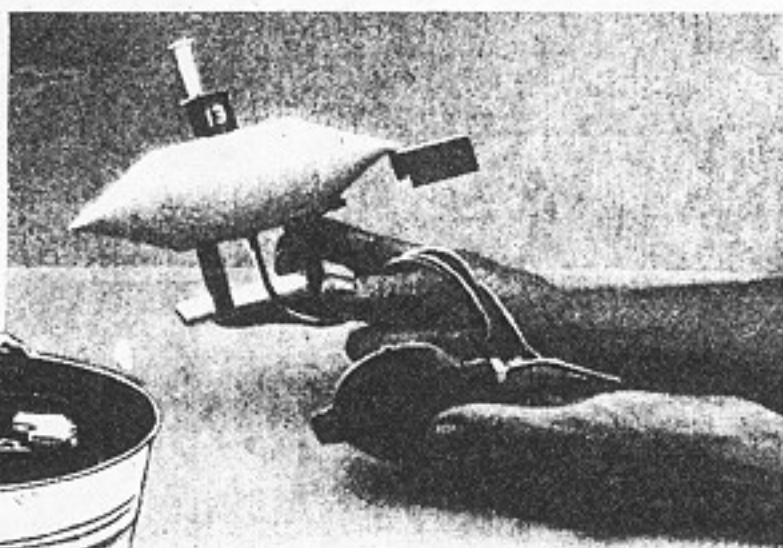


The hook is made from an old toothbrush, and the "standing" cords are merely hitched to it

PRESSING A RUBBER BULB PROPELS THIS INGENUOUS

POPULAR SCIENCE Feb. 1935

Toy Submarine



The complete submarine with rubber tube and bulb. When air is drawn out, it fills and submerges, and pumping air in makes it rise. Forcing water or air through a propulsion tube moves the "sub" forward. At left: Diving under a wooden "ice floe"

THIS amusing little submarine can be operated in an ordinary tub or a bathtub full of water. It will move forward on the surface, submerge, travel under the water, and rise again.

The hull is made from a small tin can about 2 in. in diameter and 3 in. long, with both ends removed. If such a can is not obtainable, you can make one from the tin of a larger can.

The cone-shaped ends, the conning tower, and the periscope are made as shown. The small tin tubes are formed around a nail of the proper size. The nail is then removed and the seam soldered. The 4-oz. lead weight is suspended 1 in. below the hull, otherwise the boat will be unstable.

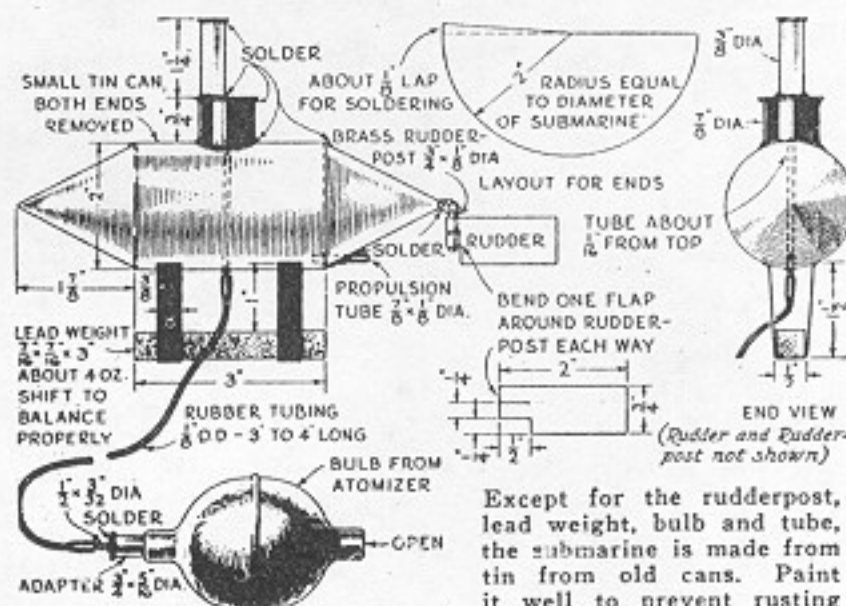
The rubber tubing should be as small and light as possible (about $\frac{1}{8}$ in. outside diameter) and 3 or 4 ft. long. Tubing such as that used on trick roses is very good. Novelty stores usually have them for sale. If one tube is too short, join two of them together. The bulb that is ordinarily attached to the tubes is rather small, but it may be used if a hole is cut in it. A bulb from an atomizer is better. The valve should be removed and the tubing attached as shown. Other details of construction are made clear in the drawings below.

The tube on the submarine to which the rubber tubing is connected extends to the top of the hull, and the only other opening into the boat is the propulsion tube. Thus, to submerge, air is drawn out by means of the bulb and water enters through the propulsion tube at the stern. The vessel will settle lower and lower until finally the periscope goes under. If you wish, you may submerge until only the top of the periscope is in view.

To bring the submarine to the surface again, simply pump air in by squeezing the bulb while the thumb is held over its open end. Then, before releasing the bulb, remove the thumb, and before squeezing it again, replace the thumb. When drawing air out, the operation is reversed.

To propel the submarine forward on the surface, set the rudder as desired. Next, compress the bulb and draw air out of the boat until the deck is awash. Then press the bulb steadily. As water is forced out of the stern tube, the boat will rise and move forward at a fair rate of speed. Keep your thumb on the bulb opening and allow the bulb to expand; then repeat the operation.

The most interesting trick is to propel the boat forward without rising to the surface. In order to do this, submerge until resting on the bottom. Then force air into the boat until it just starts to rise



Except for the rudderpost, lead weight, bulb and tube, the submarine is made from tin from old cans. Paint it well to prevent rusting

A BLOWPIPE FOR GAS

Popular Mechanics, 1919

Every experimenter who has a gas connection within convenient distance of the workbench should provide a 4 or 5-ft. length of $\frac{1}{4}$ -in. rubber tubing, terminating in a brass tube through which air may be blown in order that a clear blue flame may be available for either hard or soft soldering. The brass tube should be 4 or 5 in. long and fitted at one end with a removable nozzle having a $\frac{1}{16}$ -in. hole in it. A hole is then drilled in the side and a



piece of smaller brass tubing, bent as shown in the sketch, is soldered in place for the air supply. A piece of soft-rubber tubing about 1 ft. long is then provided and one end slipped over the projecting end of the air pipe and the other fitted to a hard-rubber, or amber, mouthpiece. By regulating the gas supply and blowing to the proper degree, a pencil of blue flame may be produced, anywhere from 1 to 4 in. long. For heating large surfaces, the nozzle tip should be removed.

This method of soldering not only makes a better connection than the usual copper, but is instantly available and does not disarrange the several pieces where, as is often the case, it is not practicable to pin or hold them in place.

and move forward, but release the pressure before it has had time to rise to the surface. Allow the boat to sink, and repeat the operation.

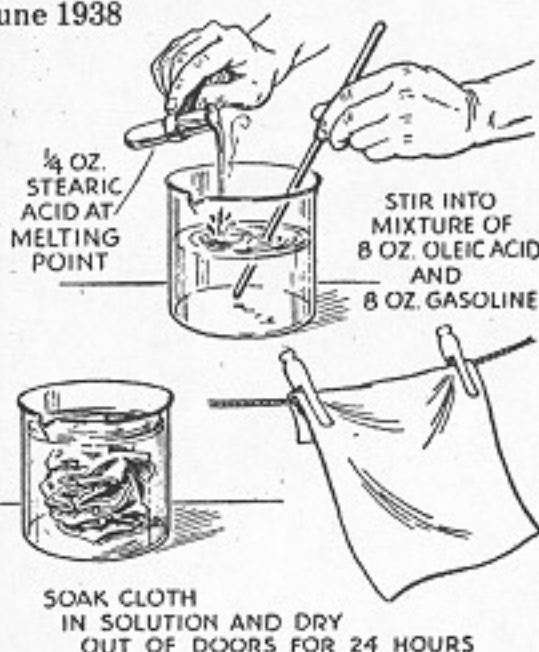
Paint some wooden blocks white, as shown in one of the illustrations, to represent an ice floe, and you can have a lot of fun trying to pass under the floe without bumping the periscope. If you come to a patch of open water, pump air in very slowly to bring the submarine straight up.—PAUL R. RANNIE.

August, 1931

CHIMNEY WASHES THE SMOKE
AND CUTS FIRE HAZARD

Magic Polishing Cloth Removes Tarnish

Popular Science Monthly, June 1938



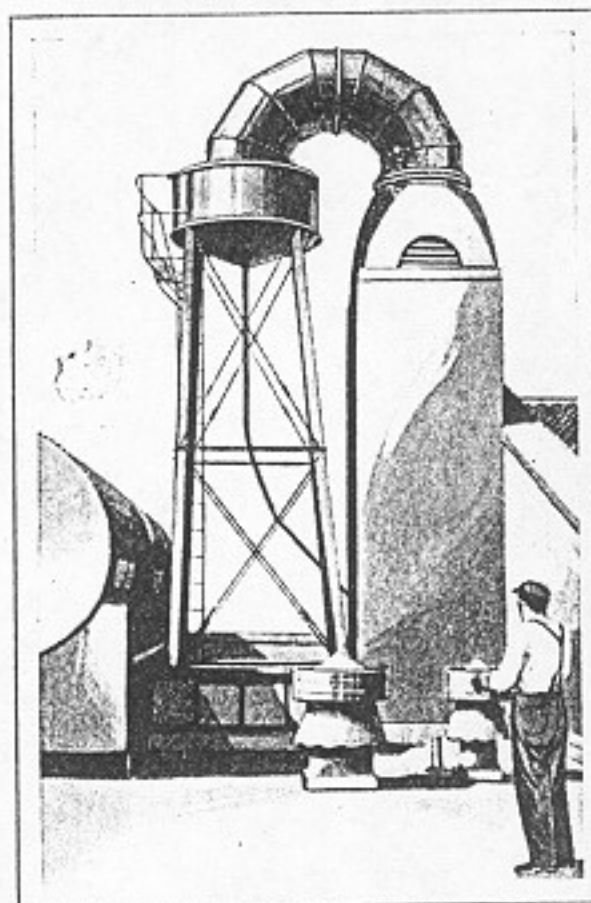
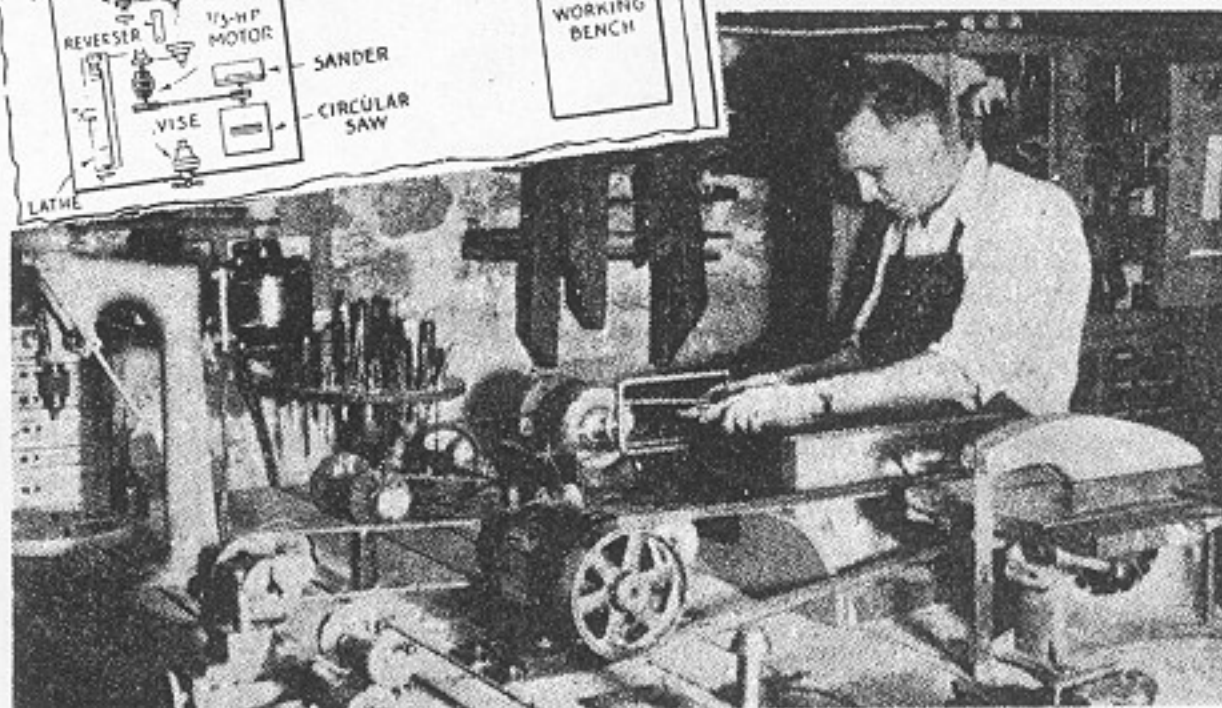
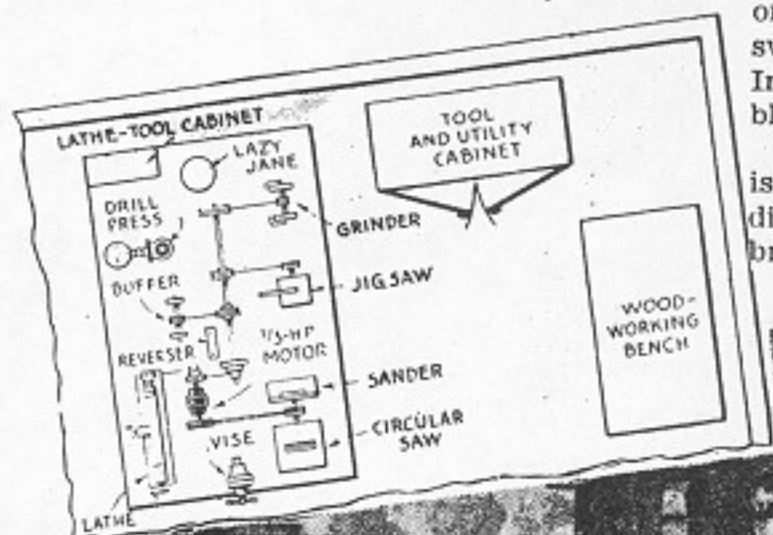
Pieces of flannel or other heavy cloth, soaked in a solution of oleic and stearic acids in gasoline, readily remove tarnish from silver and other metals rubbed with them. The drawing at the right, above, gives the successive steps in preparing the "magic" cloths

A Space-Saving Workshop Layout

Popular Science Monthly, August 1937

IN THIS workshop layout, a 1/3-h.p. equipment is on the side nearest the motor serves for all machines but the tool cabinet and woodworking bench. drill press. The operating mechanism The motor has a reversing switch to is accessible from either side of the drive machines on either side of the power table, and the woodworking table. There is a separate switchboard on the wall for motor outlets, switches, fuse block, and the like. In case of an overload, a cut-out block protects the house fuses.

Centered above the power table is a swinging light made from a discarded telephone extension bracket. □



The Gooseneck Washer for Smoke Also Acts as a Water-Controlled Damper

To reduce the smoky haze surrounding cities and to obviate fire hazards, a chimney has been developed that "launders" the smoke and quenches in the water any sparks that might fly. It is built with a curved neck emptying into a metal basin filled with water. By lowering or raising the water level the draft is regulated. Designers of the stack claim better combustion and considerable fuel savings.

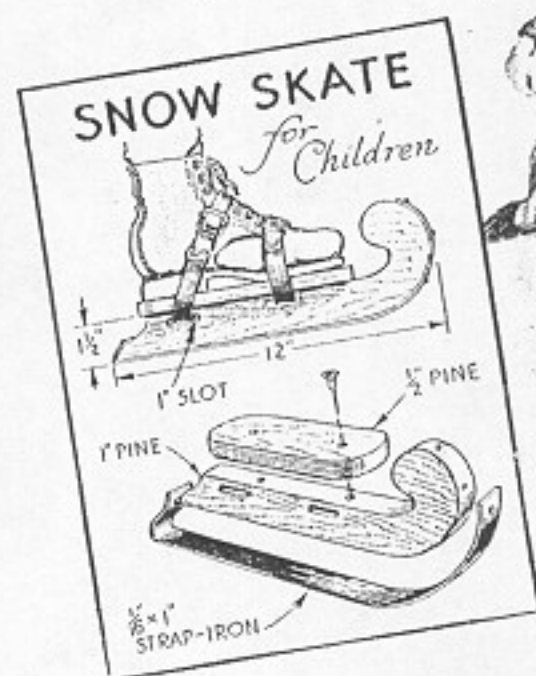
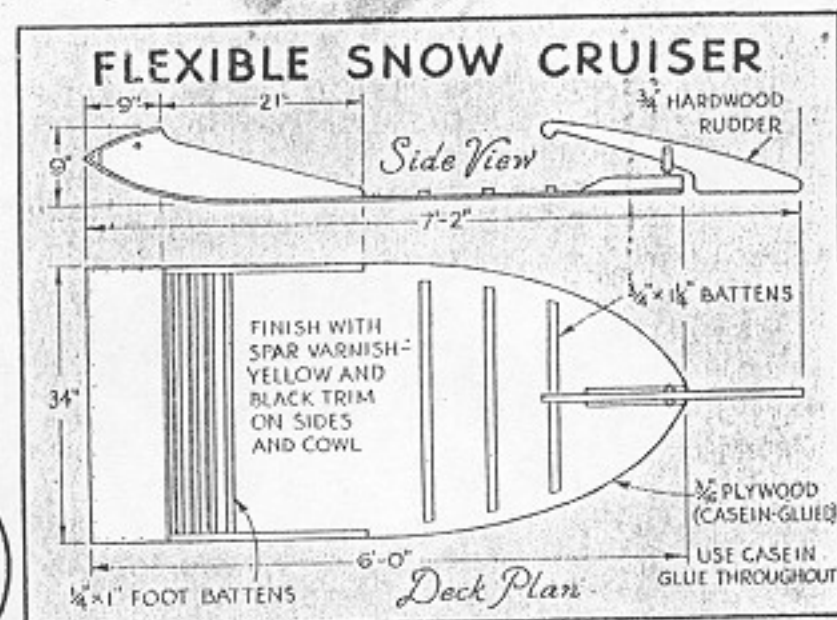
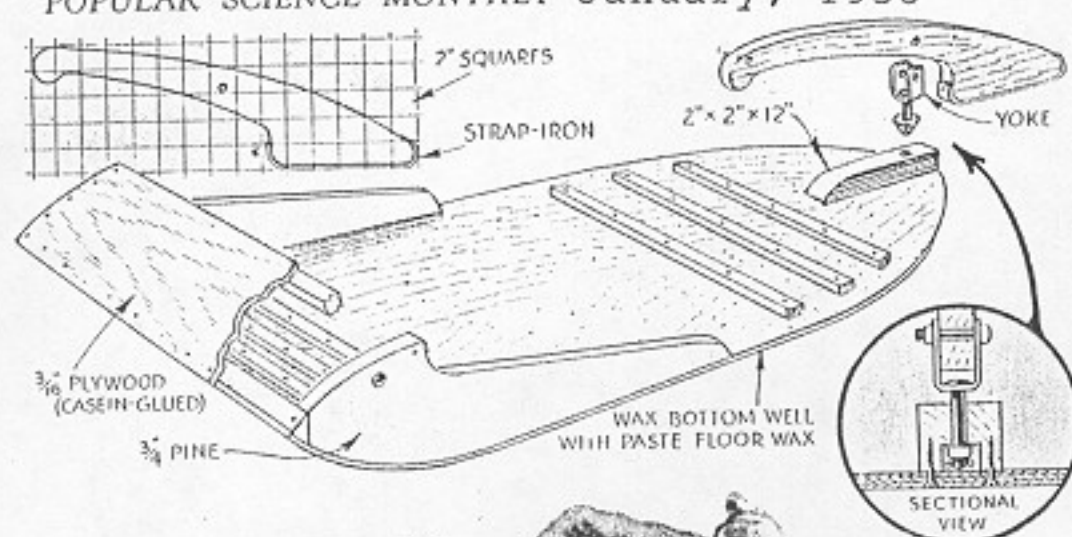
COLOR OF VEGETABLES SHOWS THEIR VITAMIN CONTENT

Color of vegetables is related to some extent to their food content, and the yellow plants furnish the equivalent of vitamin A. The pigments of plants have attained new significance through the discovery of unexpected potencies of some of their colored constituents in human and animal food, says Dr. Lafayette B. Mendel of Yale University, an authority on nutrition. Various yellow vegetables seem to furnish the equivalent of vitamin A, the food factor abundant in butter and cod-liver oil. Yellow corn, for instance, has been found more effective than the white varieties; the yellow sweet potato is richer than the white, and the yellow carrot abounds in something that can avert the lack of vitamin A in the diet. The latest findings indicate that the yellow plant pigment, called caratone, is the forerunner of vitamin A in the body. Apparently some green plants that have been known as comparatively rich sources of this vitamin carry the yellow pigment hidden beneath a veneer of green chlorophyll.

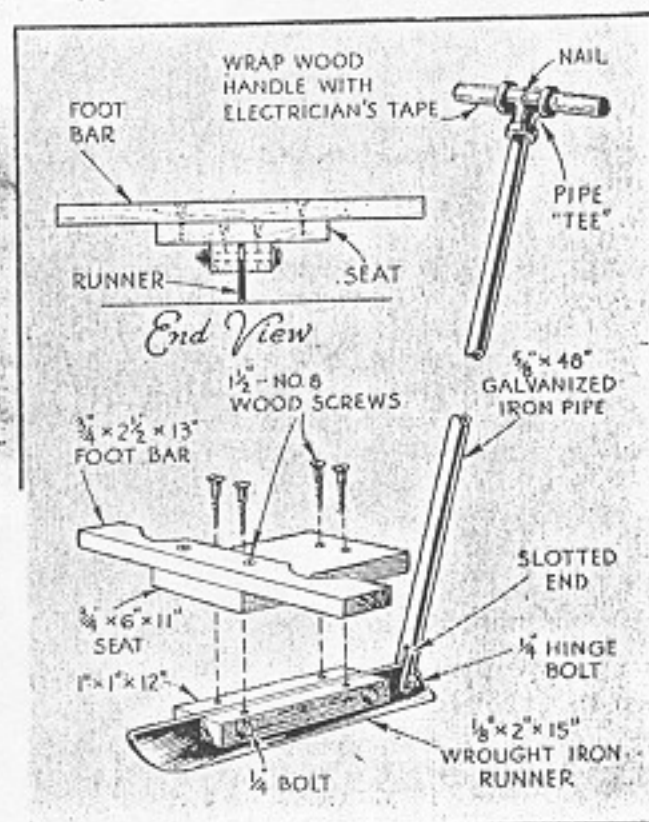
FIVE EASILY BUILT Novelties for SNOW and ICE SPORTS

By Hi Sibley

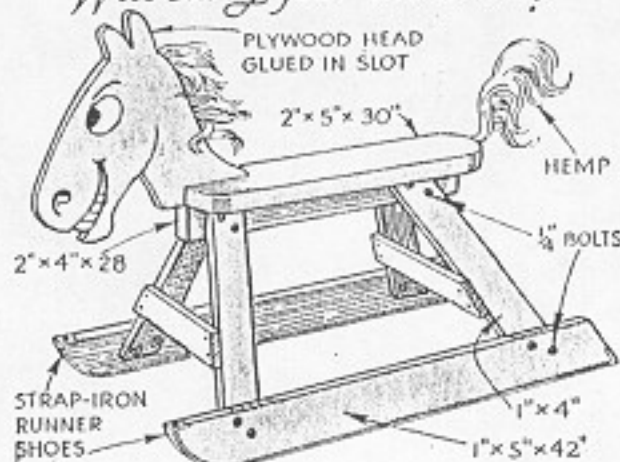
POPULAR SCIENCE MONTHLY January, 1936

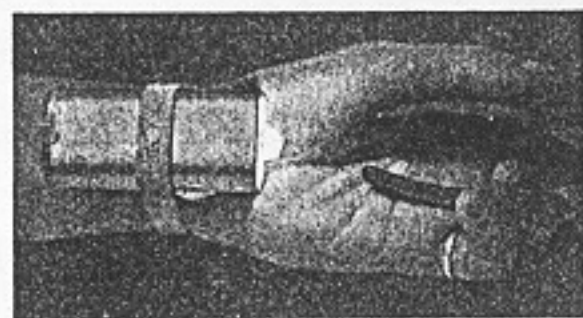
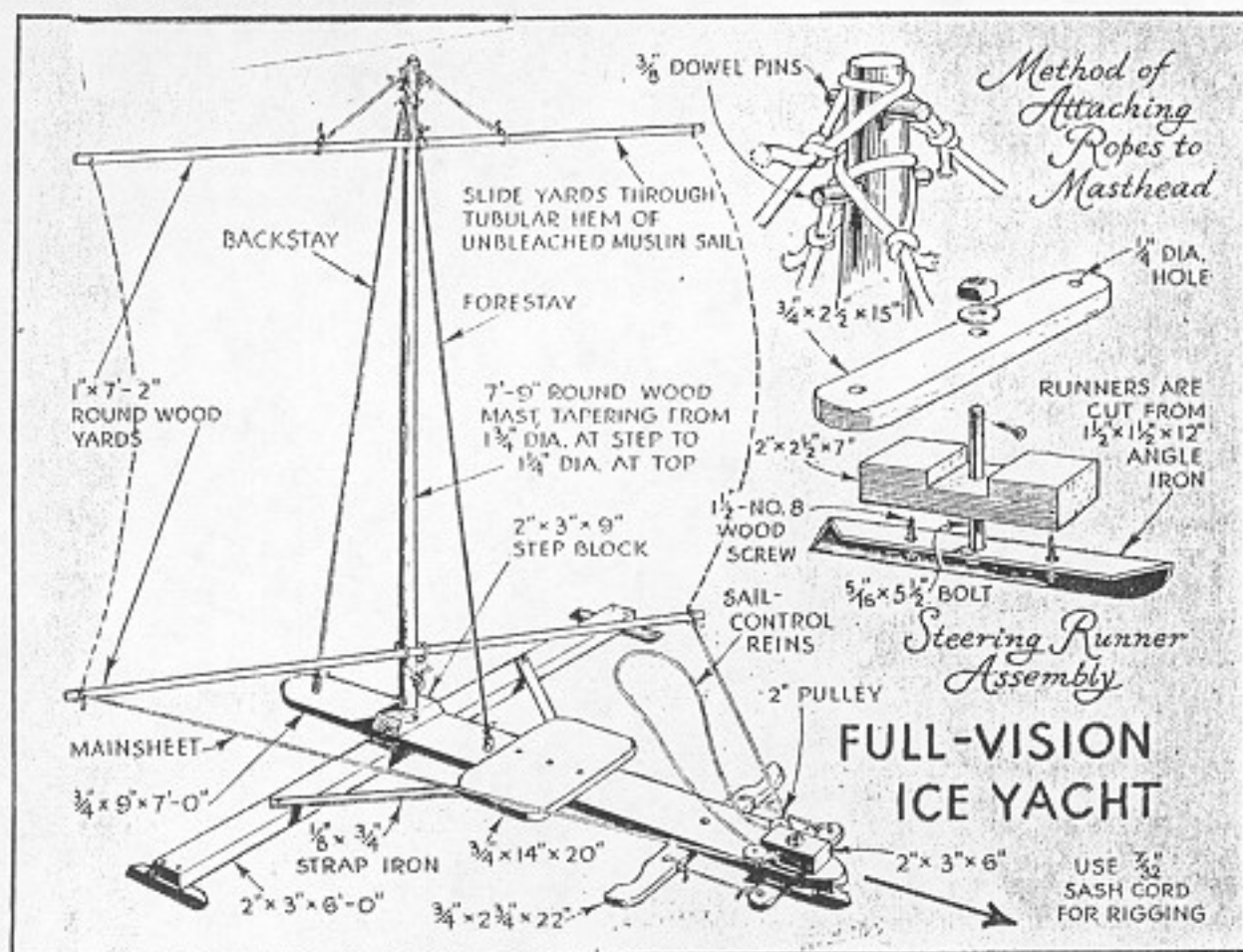


SKAGWAY SKIZZER *for use on the ice...*



ARCTIC BRONCO *Will carry four astraddle!*



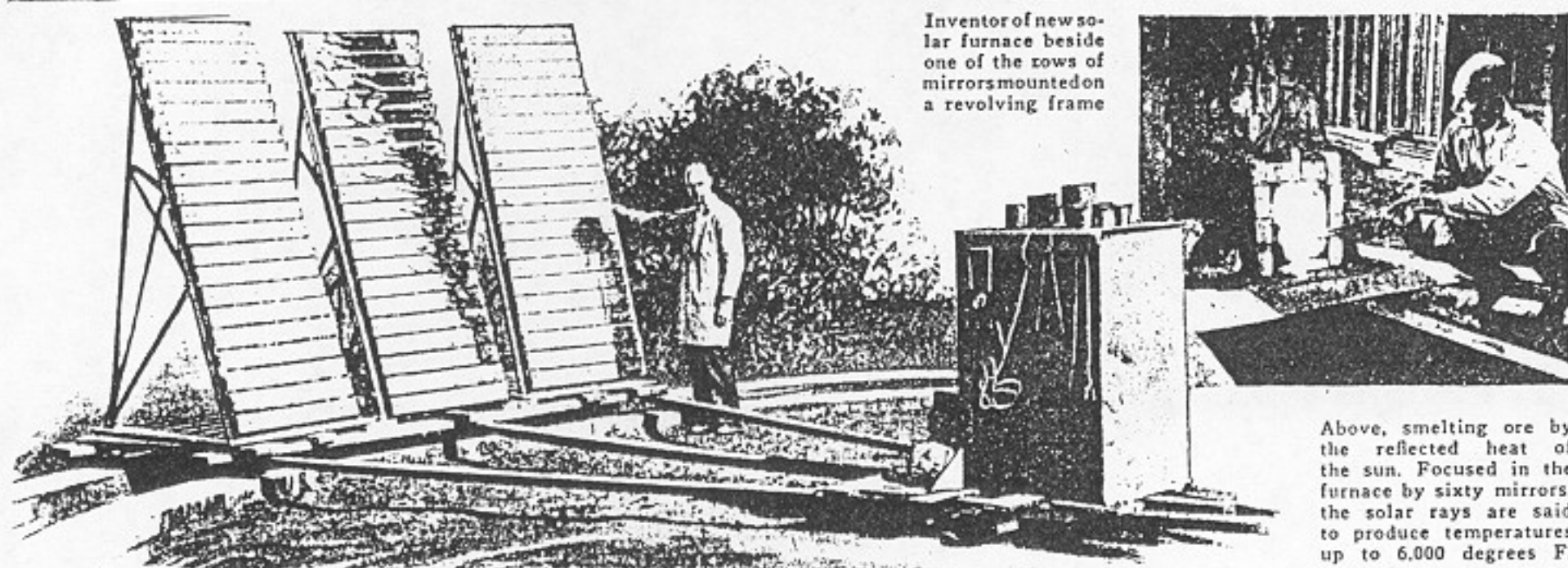


FLASH LIGHT ON WRIST LEAVES HANDS FREE

STRAPPED to the wrist, a small flash light like the one illustrated above makes it possible to use both hands when working in dark corners. A wrist-watch strap is satisfactory, and it is fastened to the flash-light case with a rivet.—E. A. BOWER.

LUBRICATING JIG-SAW GUIDES

THOSE amateur craftsmen who are partial to jig-sawing will find that it pays to use a graphite penetrating oil to lubricate the scroll-saw blade guide. The graphite fills the pores of the metal and forms a permanent lubricating surface.—K. M.



POPULAR SCIENCE February, 1936

Mirrors Capture Sun's Heat to Smelt Ore

SIXTY mirrors, arranged in three racks that revolve on a circular track, are used in a new type of solar furnace invented by a Californian. When rolled into a position facing the sun, the reflectors focus the sun's rays on the material to be

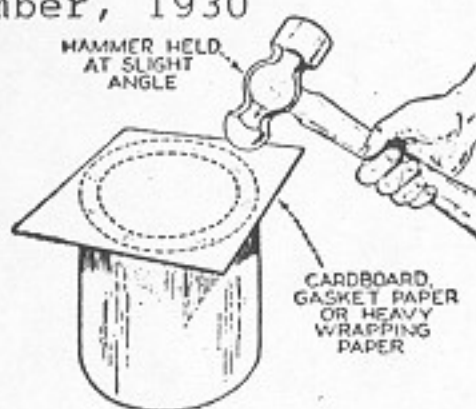
heated in the furnace. Temperatures up to 6,000 degrees F. may be obtained, the inventor declares. It is expected that the apparatus will provide a cheap heat source for a wide variety of uses, including smelting ore and superheating steam. Each ad-

ditional mirror, it is said, will add 100 degrees F. to the temperature of the furnace. The apparatus is said to be economical in both construction and operation; it can be built for about \$1,000, and only one man is required to operate it.

Science And Invention November, 1930

Easy Method of Making Gaskets

GASKETS of any shape or size may be easily made by obtaining cardboard, heavy wrapping paper or gasket paper, free from cracks or flaws and placing it over the work on which it is to be used. Then take a hammer and tap lightly around the edges of the parts



which must be cut out. Hold the hammer at a slight angle and each blow will cut through. The ball peen of the hammer will also cut the holes though a punch may be used.—Joseph D. Amorose.

PERFORMING MAGIC STUNTS WITH PAPER LOOPS

HERE are some mystifying tricks that you can do with a few strips of paper, some paste, and a pair of scissors. Cut several strips of paper about 1 in. wide and 18 in. long. Hand them to some of your friends with the request that they paste the ends together so that a single lengthwise cut will give two loops interlinked like a chain, as shown at *B* in the accompanying diagram. After this has been accomplished or demonstrated, ask them to paste a strip that will, when cut, make a loop of double the original size (*A*), or one that will give two loops interlinked and tied together (*E*), or a single loop with a knot in it (*D*). After doing one or two of these, they may "catch on" to the general method, but you can then stump them by asking them to cut the original loop so they get two loops linked together as before, but one twice the size of the other (*C*). An equally puzzling problem is to

cut the loop into a straight piece with loops at each end and these loops interlinked (*F*). To make clearer what you want them to do, it is an excellent plan to



The tricks are done with strips of paper about 1 in. wide and 18 in. long, pasted to form loops and then cut lengthwise through the center with scissors as shown

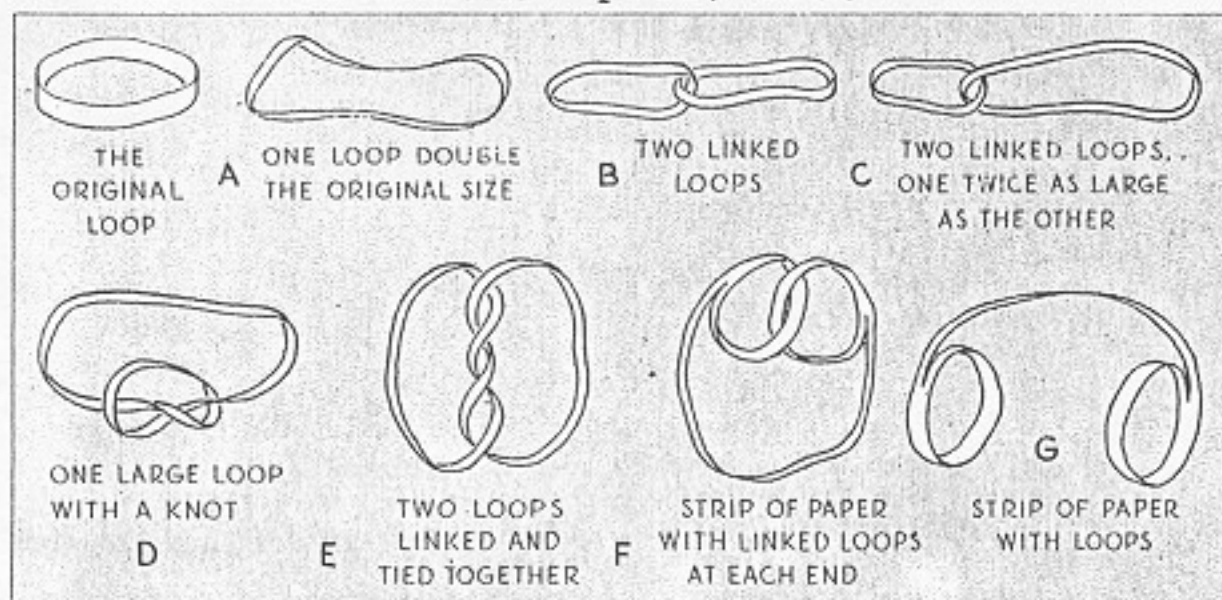
draw some rough sketches similar to those that appear in the accompanying drawing.

The different forms of loops produced are determined by the amount of twist given the original loop before pasting together and by the manner of cutting. To form *A*, give the loop a half twist before pasting and cut straight down the center. *B* requires one full twist, *D* a twist and a half, and *E*, two twists.

The other three forms (*C*, *F*, and *G*) require a spiral cut. Start about a quarter of the way from the edge and cut at a slight angle so that the scissors are cutting in the center of the strip at the end of the first cut right around the loop. Then continue around once more, gradually working over half the remaining distance, so that the cut ends at a point one quarter the width on the other side of the center. (When practicing this, it may help to draw a pencil guide line.) If this method of cutting is used, and there is no twist to the original loop, the result will be *G*. A half twist gives *C*, and one whole twist, *F*.

If you can conceal the twist in the loop while pasting and cutting it, you will have a magic stunt. First demonstrate that a simple untwisted loop, when cut down the center, makes two loops. Then make another loop, but conceal the twist behind your hand, and after cutting you will have a single large loop or two linked loops depending on the twist.—PAUL R. RANNIE.

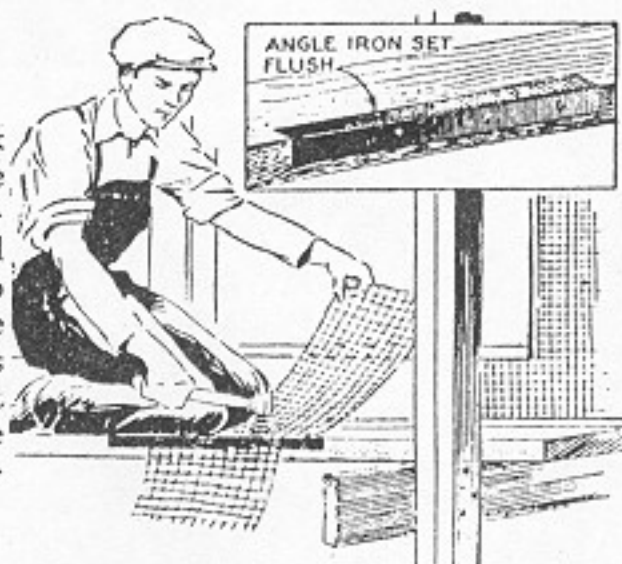
POPULAR SCIENCE MONTHLY April, 1936



The way the loop is twisted before being pasted and the method of cutting determine the result

Angle-Iron "Anvil" on Scaffold Has Many Uses

Screwed to the edge of an outside plank of a carpenter's scaffold, a length of angle iron will serve as an anvil for straightening nails, for shaping and bending metal shingles and flashing. Also, the sharp edge comes in handy for cutting wire mesh and metal lath. If an old bed rail is available, it is better than angle iron, as it is harder. It should be set flush with the surface of the plank to avoid any possibility of the worker tripping over it.



Angle iron on edge of scaffold plank is handy for straightening nails and metal and for cutting wire mesh and metal lath

Popular Mechanics

July 1937

Popular Mechanics 1947

Tacks Hammered Into Play Board
Are Pegs for Yarn Outlines

To most children, a hammer and some tacks will supply hours of amusement. Just supply them with a smooth board about 15 by 20 in. and let them pound tacks into it at random. Then, after they are tired of this pastime, a ball of yarn can be brought out to continue the fun. Looped over the tacks, the yarn can be strung to outline animals, boats and other familiar objects.—Mrs. Hal Geihm, Aurora, Ill.

POPULAR MECHANICS

January, 1937

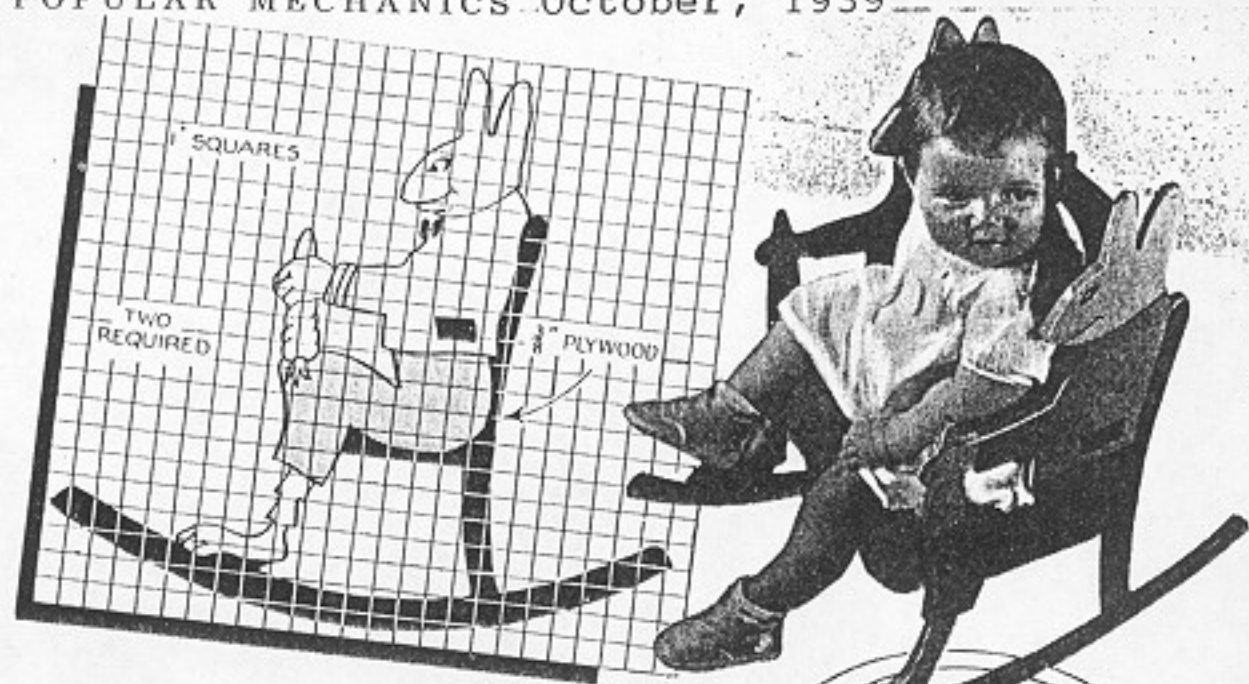
Coil Springs Are Quickly Made
with This Wire Winder

You can do a neat job with this winder, which has an adjustment to gauge the tension on the wire

To wind coil springs by hand, this simple winder will save work and enable you to do a neat job. Made from a length of flat iron, the winder is curved at one end to fit the contour of the mandrel on which the wire is being coiled, the wire being fed through two U-bolts, which are tightened to adjust the tension on the wire.

It's Fun to Rock Between These Two Bunnies

POPULAR MECHANICS October, 1939

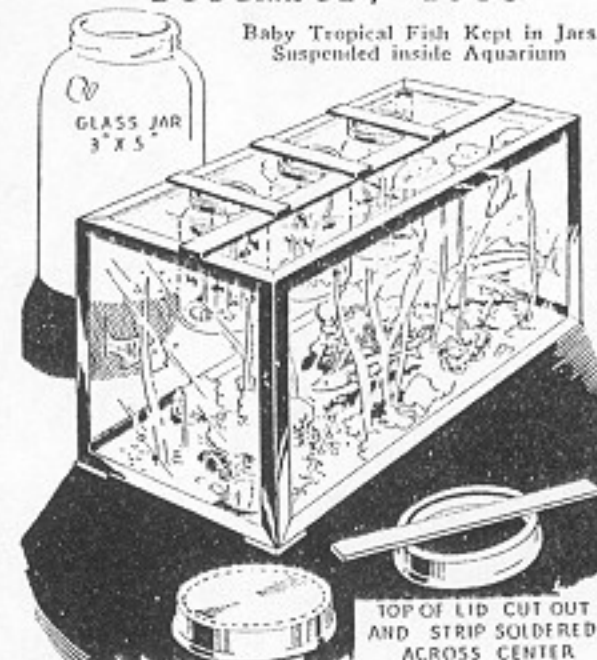
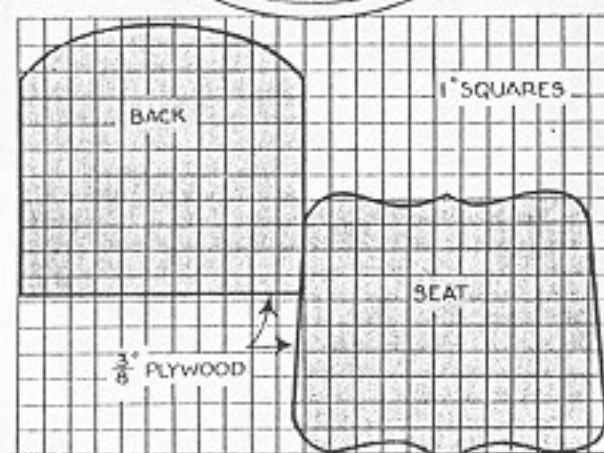


Guarded on both sides by colorful cut-outs of Peter Rabbit, this little girl enjoys sitting in her bunny rocker. The chair is sawed from $\frac{3}{8}$ -in. plywood and consists of four parts—a seat, back and two sides. The rockers are integral with the sides. In assembling the chair, the edges of the seat and back are butted against the sides and fastened with glue and screws spaced about 3 in. apart. Or, you can use cleats under the seat and behind the back for additional rigidity. The cleats are first screwed to the sides, then the seat and back are screwed to the cleats. Painting in bright colors enhances the appearance. First give the wood a coat of shellac and sand lightly when dry. Then finish as desired, painting the cut-outs in identical colors on both sides. The original chair had dark-blue rockers, seat and back, and the bunny cut-outs wore brown trousers and green jackets. Their faces, feet and hands were pale pink. Black neckties, jacket pockets and trouser stripes offer just the right contrast. The carrots in their hands are orange and the eyes are black with yellow pupils.

—Floyd Mix, Chicago.

POPULAR MECHANICS

December, 1933

Baby Tropical Fish Kept in Jars
Suspended inside Aquarium

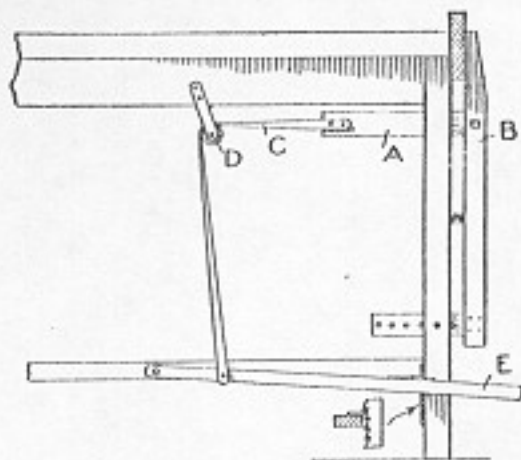
Nursery for Baby Tropical Fish

In order to maintain the correct temperature for baby tropical fish, I kept them in small glass salad jars suspended inside the aquarium. To do this, the top of each jar lid was cut out and a brass strip was soldered across the center as shown in the detail. When the jars are hung in the aquarium, one end of each strip rests on the edge of the aquarium and the other end rests on a bar placed lengthwise across the center of the aquarium. Both the strips and the bar should be as thin as possible so that the aquarium lid can be put in place.

Homemade Bench Vise Popular Mechanics — 1915

A form of a bench vise that can be easily made and attached to a workbench is shown in the illustration. This vise requires no screw, and the parts can be made from scrap material.

The substitute A for the screw is a rectangular piece of wood and is fastened with a tenon in a mortise cut in the vise jaw B. The clamping ar-



The Vise Jaw as It is Attached to the Bench and the Substitute Screw Arrangement

angement consists of a strap, C, attached to the piece A, then run over a pulley, D, and fastened to a foot pedal, E. The foot pedal is fulcrumed on a crosspiece of the bench and has a ratchet so as to hold it when the vise is set. The lower end of the vise is fitted with the usual form of device for parallel adjustment. A coil spring is located in the center for use in quickly opening the vise when the foot pedal is released.

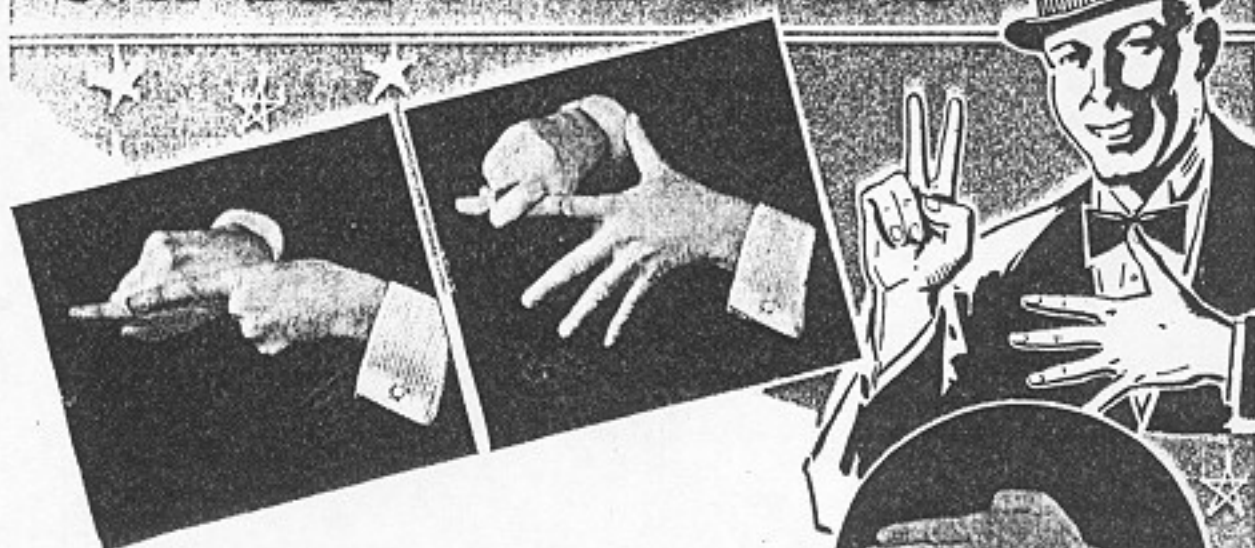
POPULAR MECHANICS
April, 1939

Walnut Meats Are Not Damaged When Cracked on V-Block



The next time you have a number of English walnuts to crack, and want the meats undamaged, use a V-shaped wood block as shown in the photo. Set the walnut on the block so that it rests midway between the two ridges, and tap it with a hammer.—D. Stratton, Lakeside, Wash.

MAGIC HANDS



Here are tricks to perform with your fingers. Practice makes them appear bewildering. Top, (left and right) stretching a finger: first, place left index finger on right index finger, then right second finger on top of left index fingernail, curling it around to hide joint. Keep both index fingers straight. Right (top to bottom) amputating a thumb: place left thumb with joint bent inward; then right thumb against left thumb, also with bend at first joint; next, right index finger hides gap of joint; finally, right thumb is slid back and forth along left index finger to get best effect.

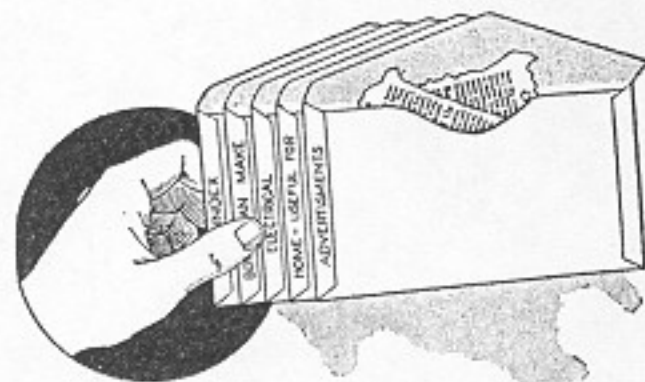
Popular Mechanics
May, 1939



Left, jerking off thumb: left hand is stretched, then right hand grabs quickly at left thumb. Left thumb is placed down behind the hand against palm. Right fist next comes away with right thumb sticking out between second and third fingers. Thumb can be wiggled as though still alive, though apparently jerked off the hand.

Popular Mechanics, 1919
Clipping File Made of Envelopes

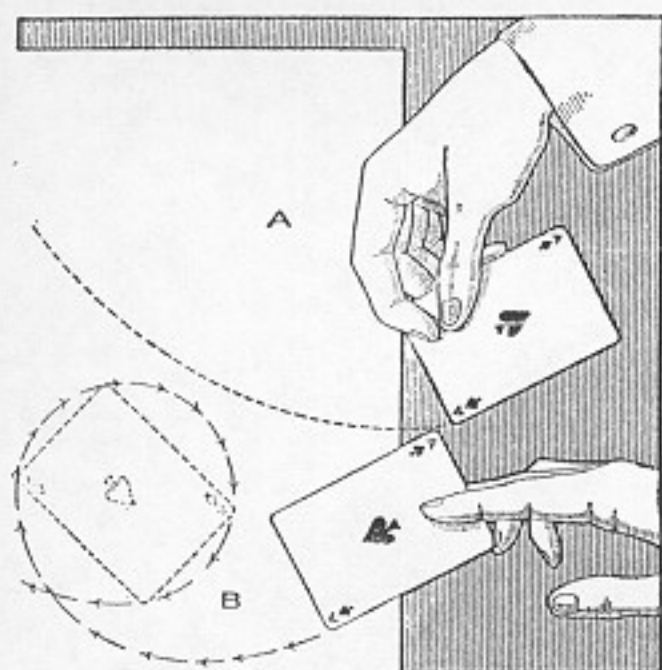
Handy pockets for holding notes, or small articles, may be made by anyone from ordinary envelopes. The gummed flaps of the envelopes are stuck together after spacing the envelopes to allow a small margin at the end on which the contents of each separate pocket may be written.



The Flaps Hold All the Envelopes Together, Producing a File of Several Compartments

Tossing a Card at a Mark Accurately

There is an interesting old game that can be played instead of solitaire. It consists in trying to toss the great-



Tossing Cards Accurately so That They will Fall into a Receptacle Set at a Distance

est number of cards into a small basket or an upturned stiff hat, set at a distance. If the cards are held as shown at A, and tossed as at B, they may be thrown with surprising accuracy.

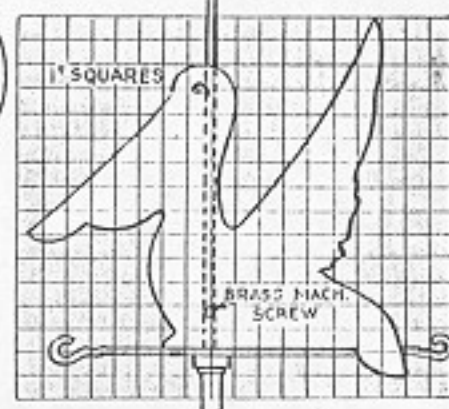
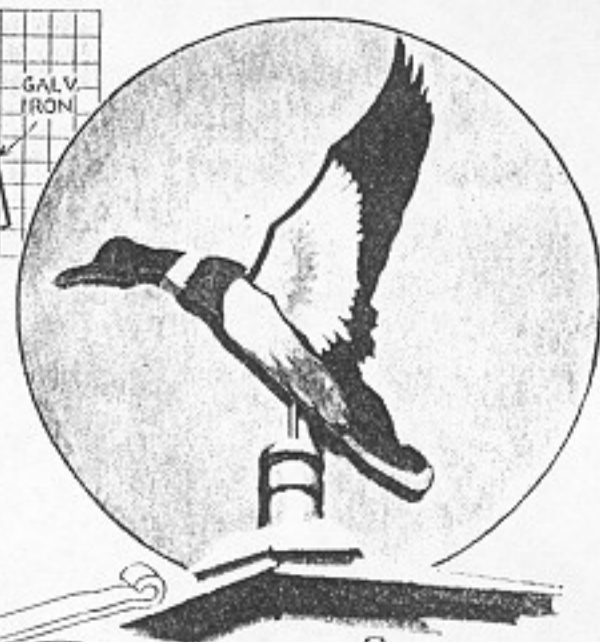
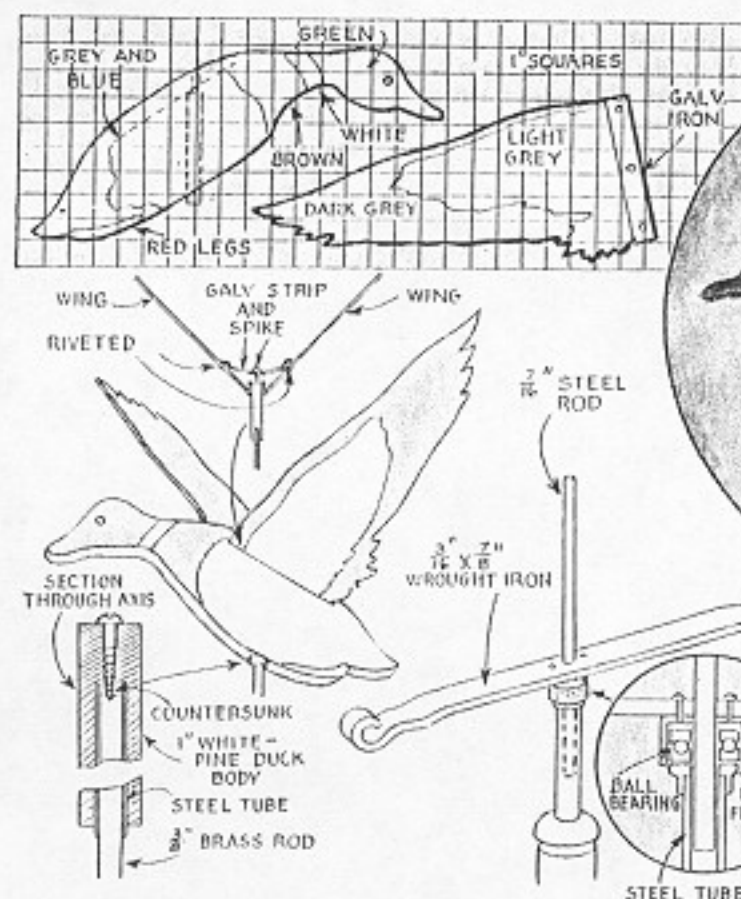
Popular Mechanics, 1919
A Cat-Proof Bird Table



Our bird table is a source of great enjoyment, particularly since the birds feel secure from cats or other enemies because of the construction of this ornament in our garden. The sketch shows the arrangement of the table braced at the top of a 6-ft. post. Shrubby surrounds the table and a light evergreen climber clings to the post, yet does not give the cats a good foothold. Experience has taught us that birds in general prefer bread crumbs to other varieties of food, and they are also fond of cracked wheat. The linnets like oranges particularly. We cut an orange in two and place the halves on the table. It is amusing to see the birds balance on one side of the orange while they peck at the fruit. Soon the orange

POPULAR MECHANICS July, 1939

Water Fowls Are Imitated in Weather Vanes



Poised with outspread wings as though about to take off the water, this mallard-duck weather vane is surprisingly lifelike, in spite of the fact that its flat, plane surfaces are of wood and sheet metal. The body is scroll-sawed from white pine and the wings are cut from galvanized sheet iron. The latter are attached to the body with small screws, and braced by a galvanized strap riveted between the wings and supported by a large spike. The duck is mounted on a weatherproof axis that turns freely without lubrication. A steel tube is installed in the body and at the top a wood screw with the point slightly

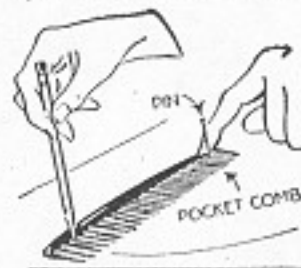
rounded is set in a countersunk brass rod. This arrangement is non-corroding, and the entire weight of the bird is carried on the point of the screw. Accurate painting of the duck has much to do with the lifelike appearance of the weather vane. The pelican weather vane is a sheet-metal cut-out mounted on a ball-bearing pivot shown in the lower details.

peel is almost entirely emptied. We provide a small basin of fresh water on the table, and the birds use it as a drinking cup as well as a bathtub.

POPULAR MECHANICS
November, 1939

Pocket Comb Used as Compass

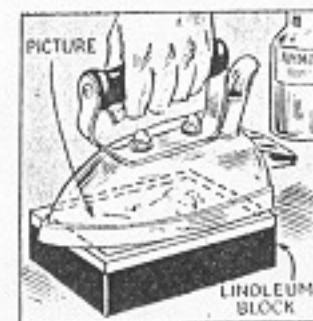
Next time you need a compass and none is at hand, a pocket comb and a pencil will serve the purpose. Sharpen the pencil point to slip easily between the comb teeth. Then hook one end of the comb over a pin driven into the work and revolve the pencil to draw the circle. If the comb is to be used often for this purpose, drill a small hole through one end in which to insert the pin.



POPULAR MECHANICS
March, 1939

Ammonia to Transfer Pictures to Linoleum Blocks

When a picture is to be transferred from a newspaper to a linoleum block to make a printing cut, moisten the picture with ammonia, lay it face down on the linoleum and weight it with an iron, so that the picture will be applied smoothly over the surface. Leave the weight in place for not more than 5 min., then remove carefully and dry the block. The picture thus transferred to the linoleum will be the reverse of the original and will print a duplicate of the original picture.



SURVIVOR

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FUN FOR BOYS AND GIRLS

By CAPPY DICK 1942

RUBBER-BAND BANJO

Play Tunes On This Musical Box

A rubber-band banjo (or, if you prefer, ukelele), really makes music.

Obtain a small cardboard box about four inches square and an inch deep. The box can be bigger, if you wish.

With a knife-point, cut a hole and a slot in the lid of the box (Figure 1). Out of another piece of cardboard, cut a bridge, as in Figure 2.

The tab at the bottom of the bridge should fit snugly into the narrow slot in Figure 1. The bridge will then stand upright, as on a violin.

Place the lid on the box and fasten it with glue or strips of adhesive tape.

Stretch some rubber bands of various sizes over the whole box, passing them over the bridge. The banjo is now finished. To play it, simply pick the rubber bands with your fingers or a toothpick.

You will notice that the rubber bands which are smaller and are stretched more tightly will produce the highest tones.

ICE-CREAM-STICK FAN

A Splendid Gift For Mother

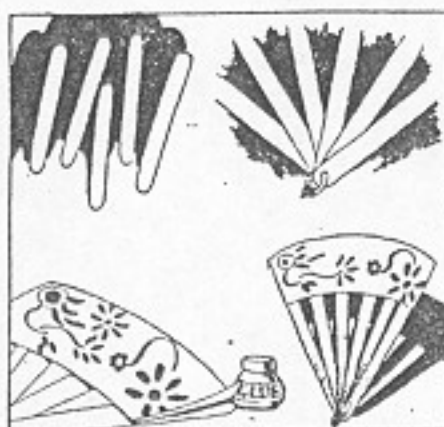
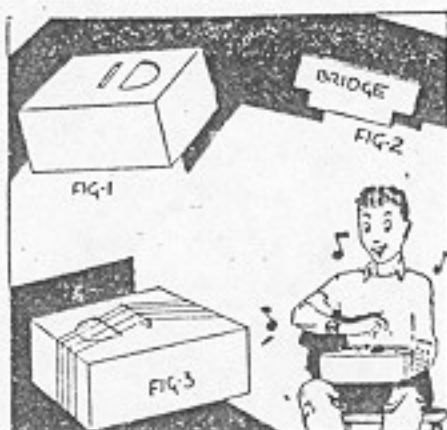
Out of the flat sticks ice-cream bars are served on, you can make a nifty fan.

Six or seven sticks are necessary. With the point of a knife-blade or some similar instrument, bore a small hole through one end of each stick. Do not crack the sticks.

Through these holes pass a small piece of wire that can be bent and fastened together to form a small loop, as shown in the upper right-hand corner of the drawing.

Spread the sticks out fanwise, and across the top ends of them glue a piece of thin paper which has been cut to the right size and shape.

After this has been done, use your paints to make an attractive design across the paper, as shown in the lower left-hand corner of the drawing. When the painting has been completed, you will have a fan that will make a very nice gift for Mother or your aunt or the lady next door who is such a good friend of yours.



JAW-BREAKERS

Things that they thought thorough seemed silly.
Sliding Sam sipped salty soup slickly.
Prudence Prim printed Patty's pretty poems.
Say this fast 10 times: Good blood, bad blood.
Mary Marlin married Martin Marvin.
Say this fast 10 times: Swiss wrist watch.
Little Larry Lang loves little Lily Law.
Swift Skippy skips swiftly.

ARABIAN RING PUZZLE

A Good Puzzle To Take To School

Anyone who would like to make a good puzzle to take to school should try the Arabian Ring trick.

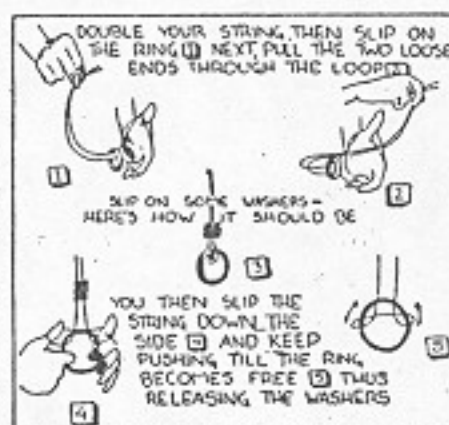
An ordinary ring is tied to a looped string. Above it are threaded two or three other rings, or washers. The problem to confront your friends with is this: Can anyone release *all* the rings from the string (without cutting it) while you hold the two ends of the cord in your fingers?

Most everybody will say it can't be done, but it can.

Figure 1 shows how to thread the first ring by putting the looped end of the string through it. Figure 2 shows how to knot the ring to the string by pulling the two ends through the loop after passing it through the ring.

Next, as in Figure 3, the other rings or washers are threaded upon the loose ends, allowing them to rest on top of the first ring.

After your friends have tried in vain to free the rings, proceed to do it yourself as shown in Figures 4 and 5. Acting quickly, simply slide the two sides of the original loop down the sides of the first ring. Immediately all the rings will be freed and will fall into your palm.



SCISSOR PICTURES

Get Your Friends To "Sit" For You

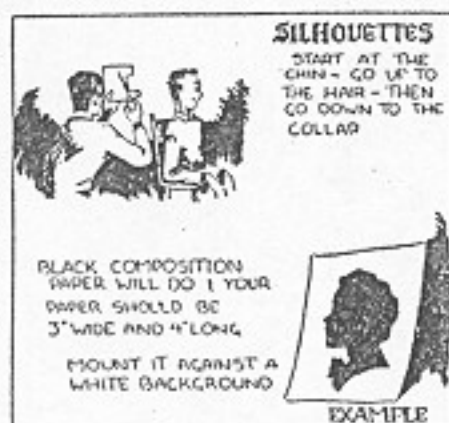
Scissor pictures are better known among grownups as silhouettes.

A scissor picture is simply a likeness of someone, cut out of black paper. It's like a little shadow. Usually it shows a side view of a person's head. When it is mounted on a white background it is quite effective.

You need a small pair of scissors and some black construction paper which you can get at your school store. Cut the paper into easy-to-handle pieces three by four inches in size.

Have your subject—your friend, or Dad or Mother—sit before you, with the side of his face toward you. Proceed then to cut his likeness out of the black paper. With frequent glances at the subject to follow his profile, start cutting at the chin. Go up to the hair and then down the back of the head to the collar and across to the chin.

Strive to cut the nose, forehead, hair-line and chin exactly as these features appear when you glance at your subject's profile.



HANGMAN GAME

You Guess A Movie Star's Name

One of the best pencil-and-paper games for boys and girls is called "Hangman."

If you would like to play it, here is how:

First draw a gallows as shown in the upper left corner of our illustration.

Next, think of a name—a movie star's name, for instance. Beneath the gallows print the initial of the first name and the initial of the last name, to serve as clues for your friend. For all the other letters in the name make little dashes, one dash for each letter.

It is now your friend's duty to guess the letters of the star's name. For example, he asks you, "Is there an A in the name?" (He can start with any other letter he chooses.)

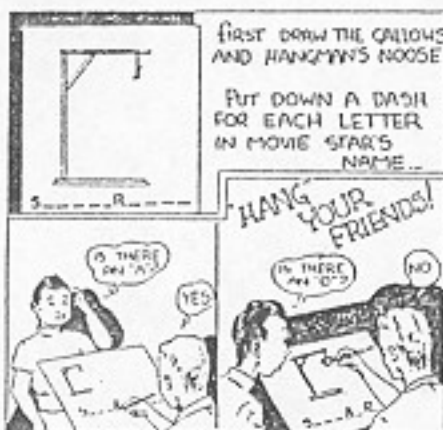
If there is such a letter in the name, you must say, "Yes," and print it above the proper dash so your friend can see it.

But if there is not an "A" (or whatever letter he chose), you must say, "No," and draw a head on the hangman's rope.

Each time your friend selects a letter that is not in the name, you penalize him by adding something to the figure on the gallows. After the head you would add a neck. Then a body, then one arm and then another arm; then, in order, and one at a time, the legs and the feet.

If your friend guesses incorrectly enough times for you to add the last foot, he has been "hanged" and loses the game.

The only way he can avoid being defeated is to guess correctly all the letters (one at a time) before he has made enough mistakes to complete the figure on the gallows. After playing one game, change places and play another.



TWO DRUMMER TRAPS

Make A Tambourine And A Pair Of Sand Blocks

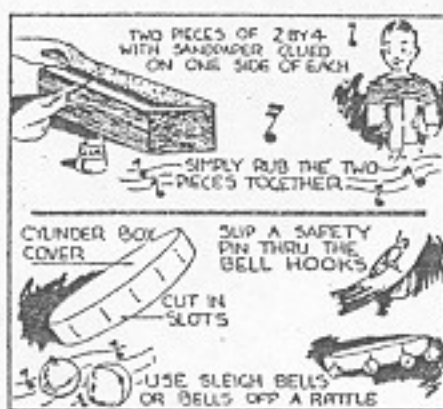
Any boy or girl who likes to keep time with the music on the radio will want to make the two devices described in the illustration. One is a set of sand blocks which, when rubbed together, make a shuffling sound that is perfect for the snappy radio tunes. The other is a tambourine that you can hit on your knee or your fist. If you make both of these instruments, you can use them alternately, just as a drummer uses his traps.

The sand blocks are just two six-inch pieces of two-by-four. Glue a piece of sandpaper to one side of each block. When you rub the sandpaper sides together, the shuffling sound will result.

The tambourine is simply the top off a round cardboard box such as some breakfast foods are packed in, equipped with four or five sleigh bells or bells off an infant's rattle.

Make slits in the rim of the box-top. Fasten the bells to it, as shown in the sketch, by inserting the bell hooks into the slits and then fastening them there with small safety pins.

When you strike the center of the tambourine on your knee or fist, it will sound something like a small drum, and the bells will jingle.



JAW-BREAKERS

Orville's office ordered Orville's office outfit often.

Bobby Brooks broke Betty Briggs' big brother's bright brown bicycle.

A CARDBOARD SUNDIAL

It Tells The Time On Sunny Days

A cardboard sundial will really tell you the time of day when the sun is shining.

To make one, use some stiff cardboard. Cut a piece six inches square. With a compass, draw on it the biggest circle it will allow. Then draw a smaller circle about half an inch inside the big one (Figure 1).

Next, mark off on the edge of the outer circle twelve equal spaces. These spaces represent hours. Draw the numerals from 1 to 12 in the area between the two circles. Make a dot above each numeral to indicate the point at which the hours will change. You can divide each hour into quarters, too.

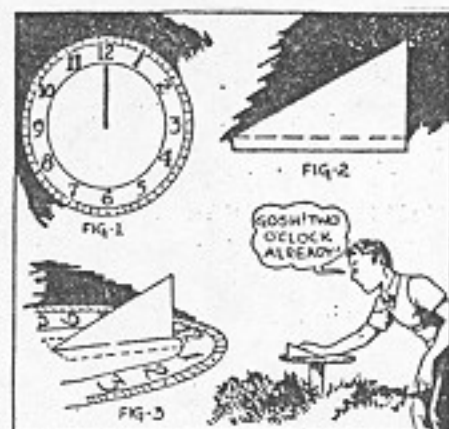
With a ruler and a sharp knife, cut a slot in the upper half of the dial's face, running up from the exact center to a point just below the numeral 12. This slot should be as wide as the cardboard is thick. The face of the dial will now look as in Figure 1.

Next, cut a piece of cardboard shaped as in Figure 2. With your knife-blade split the thickness of this piece in two from the bottom up to the dotted line shown in Figure 2. Bend the two sides up smoothly.

The final step is to slip the triangular piece into the slot in the face of the dial. So that it will stay there, put glue on the tabs and press them to the back of the dial. Figure 3 shows the dial assembled. The dotted lines indicate the tabs glued underneath.

To use it, place the dial in the sun with the back edge of the triangle pointing north.

The sun will cause the triangle to cast a shadow upon the face of the dial. If the shadow falls upon the numeral 2, it is 2 o'clock. As the sun moves across the sky, the shadow will change and move around the figures on the dial, always giving you the correct time. For daylight saving time, of course, add one hour.



POLE STUNT

It Will Give You Some Hearty Laughs

Hold one end of a long pole against the bottom of a wall as the boy in the sketch is doing.

That's all the preparation required for this stunt. From this point on, however, the problem really becomes quite intense, for the idea is to see if you can, without letting go of the pole, without moving the end of it from the wall and with-

out falling, move your entire body beneath the pole from one side to the other. You begin standing on, let us say, the left side of the pole which you are holding in your hands. You bend down and try to go beneath the pole and come up standing on the right side of it. It is fair to sit down if you think it will help you.

As you look at the picture this may appear to you to be easy. To convince yourself it really is hard, just try it. You'll be in for some good hearty laughs, especially when you try it on your friend who thinks there's nothing in the world that can buffalo him.



RUBBER-LEGGED SPIDER

Its Legs Will Wriggle

Out of a little ball of common clay you can make a spider with rubber-band legs that wriggle realistically when you jiggle it in midair.

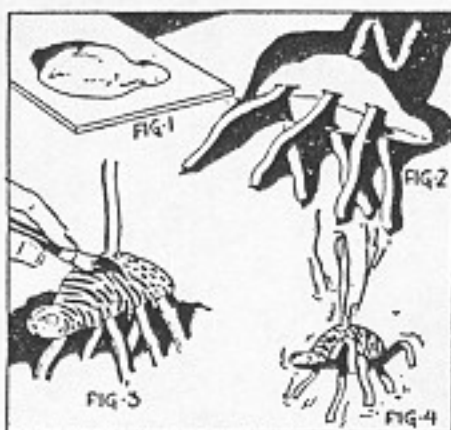
Use just enough clay to make the body of the spider (Figure 1). It should be damp clay, so that it can be molded easily.

Cut three ordinary rubber bands in half, making six pieces. These will become the spider's legs. Mold one end of each piece into the clay body as shown in Figure 2.

Cut a fourth rubber band so that it makes one long piece. Mold this deeply into the top of the spider's body, also as shown in Figure 2.

When this has been done, set the clay spider aside until it is thoroughly dry and hard. The final step is to paint its body. Black with yellow stripes will look particularly fierce. (Figure 3).

The spider is now ready. Grasp the end of the long rubber band, bounce the spider up and down in midair and watch its rubber legs dance.



ROSE-SCENTED NECKLACE

Mix Crushed Petals With Flour And Water

Next time you have a bouquet of roses at your house, make some perfumed rose beads. This is a fun-project for boys as well as girls, because boys will want to make the beads to give to their smaller sisters and girls will want to make some for themselves.

The beads not only have a rose tint, but also have the fragrance of roses.

First, cut up or grind into very small particles about three cups of rose petals. You can first crumple the petals in your hands as in Figure 1 and then, with a knife, slice them into tiny pieces.

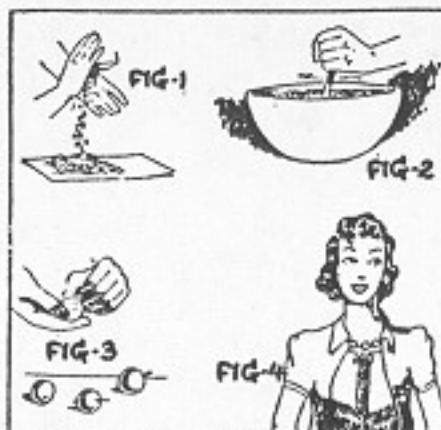
Next, make a dough of water and flour. Put some flour in a bowl, add some water and then stir it until the flour and water are thoroughly mixed (Figure 2). This dough must be very, very stiff, and to make it so you may have to add more flour to the bowl.

Put the dough on a breadboard and roll the ground-up rose-petals into it.

With your fingers, take up a small particle of the dough and shape it into a bead. You may want to make a round bead, or you may want to have long, oval beads. They can be any shape you choose. You may want to use two shapes in one necklace.

When the bead has been shaped to suit you, stick a pin through it to make a hole, and set it aside to dry and harden (Figure 3). Before the bead becomes fully hard, remove the pin so that it will not become stuck.

When all the beads have hardened, they are ready to string on strong thread. They are not only pretty to wear, as the girl in Figure 4 is wearing them, but they are also pleasingly fragrant.



INDOOR GOLF GAME

Any Boy Or Girl Can Make This Simple Equipment

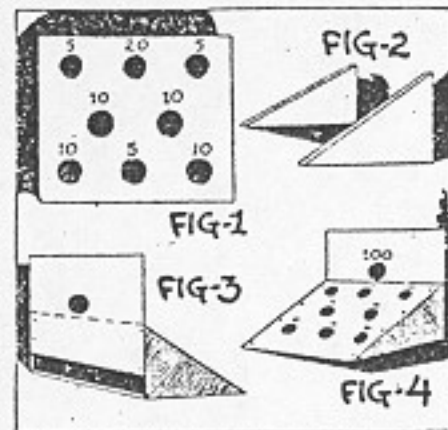
If you have a golf putter (or can borrow Dad's) you can make a game called Putt-Putt. It's an indoor golf game, perfect to play in the basement or the living room on days when the weather is bad.

An especially constructed box with a slanting top that runs up on a slope from the floor is the "green." This board has eight holes in it, big enough for a golf ball to fall through and each worth a certain amount. The players stand at a distance of 12 feet in front of the green and putt golf balls at it, trying to aim them so they will roll up the slanting board and fall into the holes of highest value. The first player to score 100 is the winner. The way to win quickly is to putt a ball through the one hole in the backboard extending above the slanting green. That hole alone is valued at 100.

Each player putts three times and then it is the next player's turn.

Figure 1 shows the board that becomes the slanting green, with the eight holes in it and their value. This piece can be made of wood, with holes cut in it, or of an old piece of wallboard. It should be about 18 inches long and 12 inches wide. Figure 2 shows the two wooden side-supports for the green to which the slanting top should be nailed. Figure 3 shows top, sides and backboard assembled. Note that the backboard does not extend all the way to the floor. This allows an opening through which you can fish out the golf balls that fall into the holes.

Figure 4 shows the front of the completely assembled game.



HOME-MADE PAPER SANDALS

They Are Fun To Make And Wear

Make yourself some bedroom slippers out of paper. Usually a pair lasts only for a few hours before becoming torn, but it's easy to make more for the next day.

Use heavy wrapping paper—the heavier, the better. Spread a piece of it on the floor and place your bare foot upon it. With pencil, draw the outline of your foot, as shown in Figure 1.

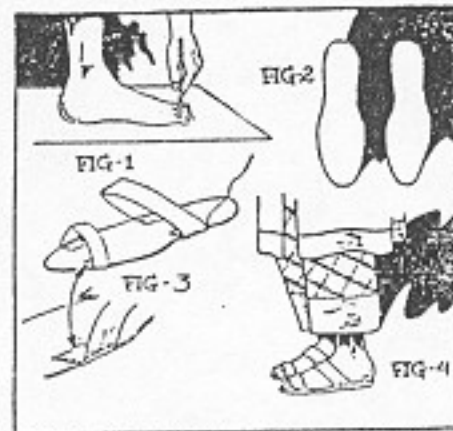
Do the same thing with your other foot, so that you have a right sole and a left sole.

Next step is to cut the soles out with your scissors. They will look like Figure 2.

Now, you must fasten two paper straps to each sole so the slippers will stay on your feet. These straps are cut out of the same paper as the soles. One goes over your toes and the other over your instep. The one over the instep must be sewed to the sole on a slant, as indicated in Figure 3.

The straps are sewed on with heavy thread and you should take large stitches, so they won't pull out of the paper too easily. If the paper is too flimsy you can glue two or three thicknesses together for the soles and for the straps, too.

The slippers are worn as in Figure 4.



OSCAR, THE HUNGRY MAN

You Toss Beans Into His Mouth

Fun with beans!

Yep—you can have a great time with a bunch of beans if you make this game, which can be played at home or school.

The game is called Oscar, the Hungry Man. A big, funny face is glued to a good-sized box which rests on a table (Figure 3). The mouth of the face, which must be quite large, is wide open.

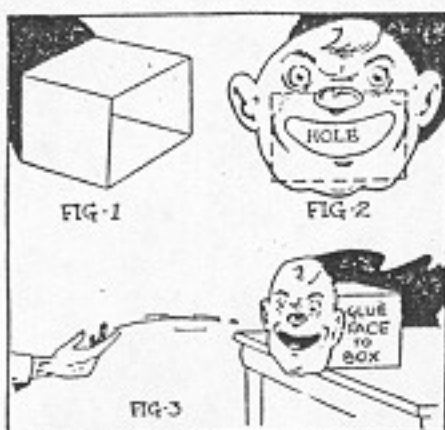
Each player has a dozen beans. One at a time the players stand at a taw-line 10 feet in front of the box and toss their beans at the mouth. The player who succeeds in "feeding" the biggest number of beans into the mouth of Oscar, the Hungry Man, is the winner. If two or more players are tied, they must play a run-off, tossing 12 beans each, to decide who is the winner.

The box, which can be cardboard, should be at least 12 inches long and 8 or 10 inches high (Figure 1). Oscar's face should be cut out of a large piece of cardboard such as is used for suit-boxes. Figure 2 shows how to shape his head. The eyes, nose, etc., are put on with crayon or brilliant water colors.

Mark off a large mouth for him and cut this out with a sharp-pointed knife.

The face should be glued or tacked to the back of the box (not the open side), but first a hole should be cut in the box where Oscar's mouth will be when the face is glued on. If this is not done the beans won't have an opening through which to pass when you take aim and toss them at the mouth.

The open side of the box becomes the back of the game, so you can easily gather up the beans that succeed in passing through the mouth and into the box.



CRANBERRY DOLLS

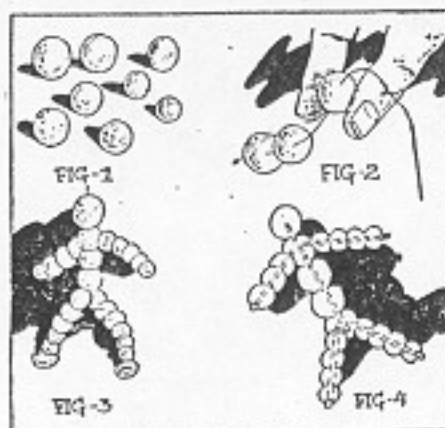
Put Together A Whole Family

During the cranberry season, make some funny little men and women out of the small red berries. Fresh peas will do as well as cranberries.

There are two ways to proceed. One is to string the cranberries (or fresh peas) on a needle and thread, as shown in Figure 2, placing them as close together as possible. Tie a large knot at the end of the thread to keep the berries from slipping off. It is easy to see, by looking at Figure 3, how the arms and legs are formed.

Figure 4 shows the other way to make these funny little cranberry people. In this method you fasten the berries or peas together with toothpicks. A fairly long piece of toothpick is pressed through some cranberries to make the body. Toothpicks of the same length are used for the arms and full-length toothpicks are strung with cranberries for the legs. The assembled result is shown in Figure 4.

It's fun to make a whole family of cranberry people—mother, father and children—and, if you are clever, you can even make cranberry dogs.



MAKE THIS OLD WITCH

You Use Crepe Paper And A Broom

Witches always provide many thrills at Hallowe'en, so you should make one with which to surprise people.

You need an old broom that Mother will let you use. Next, you need a long piece of yellow or orange crepe paper. Wrap a double strip of this paper around the broom and glue it securely.

Out of black paper cut a set of big eyes and eyebrows, a nose and a mouth with big teeth (some of them missing). Paste these on the yellow crepe paper to make the witch's face.

Cut some short lengths of rope and shred them into strings. Fasten these to the broom straws for hair, as shown in the upper half of the illustration.

Finally, out of black crepe paper, make a hat and a cape for the witch. Gather the cape around the broom handle, immediately beneath the witch's face, and tie it there tightly with string.

The witch is then ready. All you have to do to surprise the very wits out of your friends is hold the broom up at a window where they will be sure to see it.

It's bound to get results!



CRAYON-PAINT PICTURES

Effective And Unusual Drawings

Even if you aren't good at drawing, here is a fun-project that is sure to produce good results for you. By following the directions, you can make a handsome picture that is a combination of crayon and water color. The picture will have a solid background made with water-color paint, out of which will shine flowers you have drawn with your crayons of different colors. The effect is so pleasing you will want to hang the picture up in your room or give it to a friend. Other boys and girls will want to make some, too.

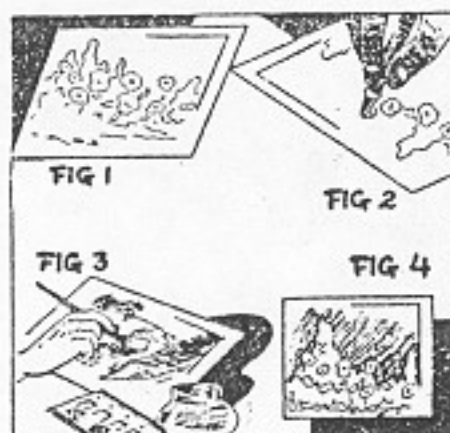
Begin by drawing on a piece of white paper a pencil sketch of the picture you want to make (Figure 1). Draw the lines lightly because they are merely a guide for your crayon marks when you draw the picture in colors.

Next, as in Figure 2, apply the crayons. Use the crayons heavily, use your brightest colors and make plenty of leaves with your green crayon. If you wish, you can draw vegetables or fruit instead of flowers.

When the crayon work is finished, the next step is to paint over the entire picture—even over the crayon marks—with black water-color paint (Figure 3). Sweep your brush all over the picture and use plenty of paint on the brush.

After doing that, set the picture aside. When the black paint has dried, the job is finished (Figure 4) and you will have one of the most attractive pictures you have ever made.

Try it! It's fun!

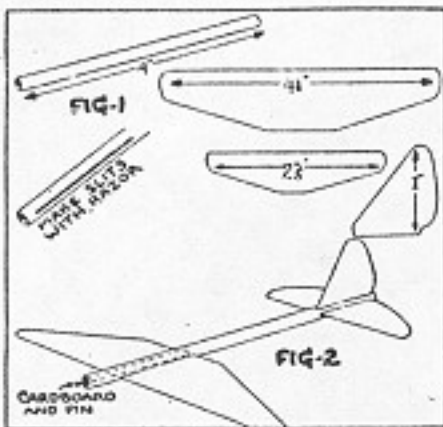


SODA-STRAW AIRPLANE

You Can Have A Whole Fleet To Fly

A soda-straw airplane is made of a soda straw, paper, and small strips of cardboard for weight. Tools needed are a razor blade, scissors and a pencil.

Off the straw cut a piece four inches long (Figure 1). Then out of the paper cut the wing, stabilizer and rudder according to the pattern also shown in Figure 1. The wing is $4\frac{1}{2}$ inches long,



the stabilizer is $2\frac{3}{4}$ inches long and the rudder is one inch high.

Next make slits in the soda straw to receive the wing, stabilizer and rudder. To do this, use the razor blade.

Starting about $\frac{3}{4}$ of an inch from the front end of the straw, make a slit $1\frac{3}{8}$ inches long straight through the middle of the straw for the wing to slide into. Then measure back about an inch and make an identical gash about $\frac{3}{8}$ of an inch long for the stabilizer to slide into. Thirdly, make a slit just about on top of the stabilizer cut for the rudder to fit into.

Then slide the wing, stabilizer and rudder into the proper slits and the assembled plane will appear as in Figure 2.

Send the plane into a test glide, and, if its tail is heavy (as it probably will be), put some weight in its nose. The weight consists of an inch-long sliver of cardboard that will fit snugly into the end of the soda straw.

If in the first test glide the nose proves too heavy, add the weight to the tail of the plane in the same manner.

Simply weight the ship until it glides perfectly, and then it is ready for flying.

To make a stunt plane, follow the same procedure, but vary the weight. Throw the plane harder. If cardboard strips do not provide enough weight, stick a pin into the cardboard (Figure 2) and that will help.

To launch the plane, take hold of it anywhere on the straw and throw it forward hard or easy, according to the performance you want.

It's fun to have several of these ships—some straight gliders and others built for stunting.

HOW TO MAKE FALSE EARS

They Make You Look Mighty Funny

Would you like to "dress up" to look funny? I know a new way for you to get yourself up in a funny outfit just by making yourself some big ears.

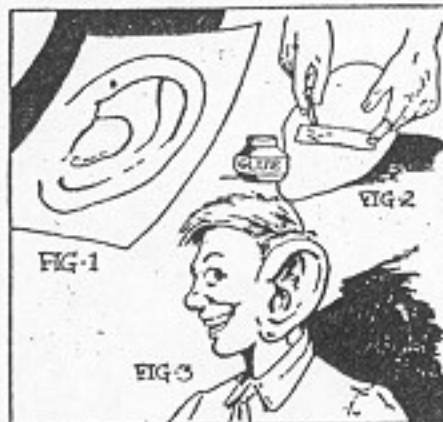
Want to try it?

All you need is some heavy paper (wrapping paper will do, or you can use drawing paper), some glue and some crayons.

On a sheet of paper about seven inches square, draw the outline of a large ear, as shown in Figure 1. Make it look as much like a real ear as you can. If you follow the lines in Figure 1 you will do a pretty good job of drawing. Color the ear with your crayons. You can use pink, with red for the outlines.

Use this one ear as a pattern for another one on another sheet of paper.

Cut both ears out with your scissors and then cut two strips of the same paper, making them about four inches long and an



inch wide. These strips are the bands by which the false ears will be held onto your real ears. One strip is fastened to each ear.

Glue the ends of the strip to the back of the false ear (Figure 2). Do not glue the entire strip, for the center of it must be left free so you can slide the top of your real ear beneath the strip.

When the glue has dried, you are ready to hook the false ears over your real ears. The effect will be as in Figure 3.

HOW TO PAINT WEEDS

A Bouquet Will Look Good In Your Home

With but little effort and skill, any boy or girl can make a bouquet of painted weeds pretty enough to put in a vase at home or in school.

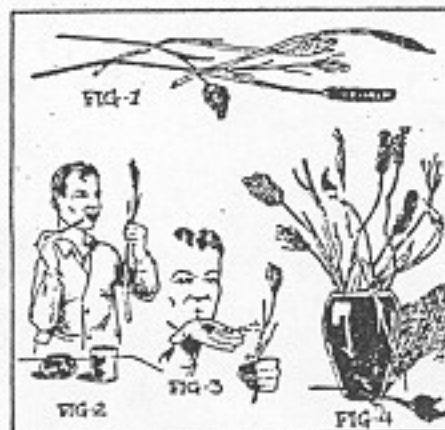
After the second or third frost in the fall, by which time all the weed patches will be thoroughly dried out, take a pocketknife and cut an armful of the most interesting-looking weeds you can find. Milkweeds are always pretty, and cat-tails are good, too, but there are many other kinds equally suitable. Take a hike and you'll find plenty.

The weeds—leaves, stems and all, as shown in Figure 1—must next be painted with metallic paint, which is the kind used for painting radiators. It usually can be had in aluminum and in gilt and can be purchased at a hardware store. Apply this paint to the weeds with a small brush, as the boy is doing in Figure 2.

While the paint is still wet, pour some bronze dusting powder on your hand or on a piece of paper and blow it upon the weed. The bronze powder can be bought for a few cents. Sprayed over the aluminum-colored weeds, it will give them a colorful appearance that the aluminum paint alone does not achieve.

Treat all the weeds in the same manner and, after the aluminum paint has dried, with the bronze dust scattered over it, place them in a vase and put them in your own room.

A similar bouquet would look nice in your schoolroom, too, and perhaps your teacher will allow you to display some there.



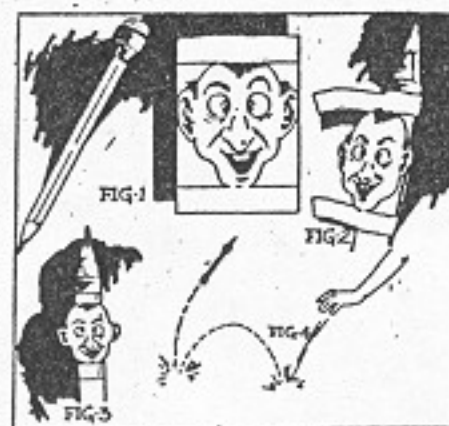
A PENCIL CLOWN

He Bounces Into The Air

To make a pencil clown, which is a simple but highly amusing toy, you must have a pencil with a big eraser on it (Figure 1). On a piece of fairly heavy paper draw the face of a funny man, as in Figure 2. Cut this face out of the paper with scissors, leaving a tab at the top and bottom that can be wrapped around the pencil. Next, glue the face to the pencil, directly under its point. Put glue on the tabs and wrap them tightly around the pencil (Figure 2), and when you have done this the man's face will appear as in Figure 3.

To use the pencil clown, throw him to the floor, eraser end down. The eraser will strike the floor and will cause the clown to bounce up into the air one or more times.

It's lots of fun!



CORN JEWELRY.

Kernels Make Good Necklaces And Bracelets

In this day, when girls are wearing necklaces and bracelets made of almost anything, including miniature frying pans, teakettles and animals, we shouldn't overlook the possibilities of corn.

Kernels of bright, yellow field corn—the kind horses eat—can be made into fascinating necklaces and bracelets that will attract lots of attention.

Shell a lot of kernels off an ear of yellow corn. If you can get some Indian corn, which is deep red in color, that will help make the necklace and bracelet even more attractive. Select only the best kernels.

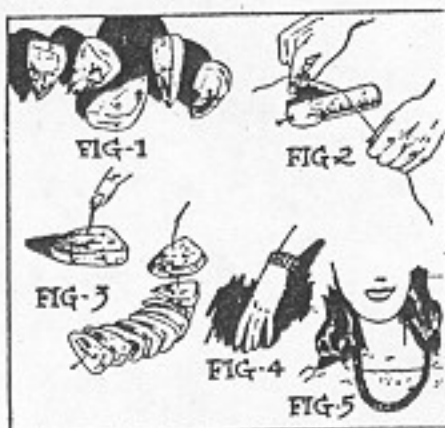
Next, prepare a piece of strong, heavy white thread by waxing it. To do this, simply run it over a candle several times, as shown in Figure 2.

The third thing to do is carefully pierce each kernel of corn with a pin, making a tiny hole through it from side to side, as in Figure 3. Be cautious, so that you do not split the kernels.

After the pin-holes have been made, put the waxed thread into a needle and proceed to string the kernels snugly together (Figure 3). Be sure the thread is long enough to make a necklace.

A bracelet is made in the same manner. You can, if you wish, wear more than one strand of kernels for a bracelet. If you do, you can tack them together at several points by tying a thread from the string of one strand to that of the next.

The corn necklace and bracelet, when worn together, make a pretty ensemble for any schoolgirl.



INVISIBLE SPOT STUNT

The Spot Will Vanish Before Your Eyes

Anybody can make a visible ink blot become instantly invisible by following these directions. It's an amazing stunt, easy to perform and ideal to show to other boys and girls.

With pen and ink (or black crayon) make two spots as large as a nickel on a piece of paper, as shown in Figure 1. They can be near the top of the paper, or at its center, if you wish. But they must be no more than about three inches apart and they must be on an even line.

With the spots drawn, hold the paper up before your eyes at your usual reading distance. Close your right eye and leave your left eye open.

Look at the right-hand spot with your left eye. Then slowly move the paper up and down in front of you, as in Figure 2.

In a few seconds you will discover that when the paper reaches a certain position the left-hand dot has become invisible.

To make it visible again, simply move the paper either up and down from the position at which the spot vanished . . . or, of course, open both eyes.

This really works. If at first you seem unable to make the left-hand spot vanish, just keep on trying. It will become invisible to you.



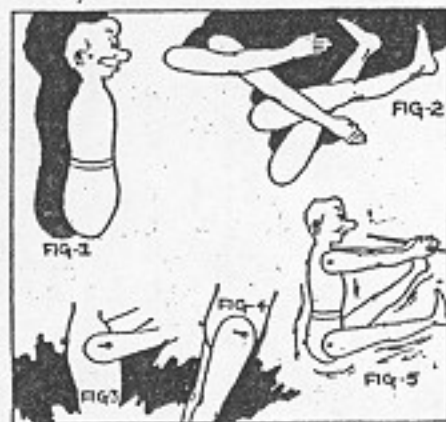
PASTEBOARD ACROBAT

He Swings With Great Ease On A Toothpick Trapeze

When you want something easy and amusing to do, make a paper acrobat.

The paper should be heavy. In fact, it should be so heavy that lightweight pasteboard will do.

Cut the profile of the man's face and upper body out of this pasteboard as shown in Figure 1. Draw in his eyes, nose, mouth and hair.



Cut out two arms and two legs as in Figure 2. With a pin make a small hole in the top of each arm and leg and in each hand. Also make a hole in the body where the legs should be attached, and one for the arms.

Fasten the man's arms and legs on by sticking a pin through the holes. With pliers bend the point end of each pin up. Figure 3 shows how to fasten on the arms and Figure 4 shows how to fasten on the legs. The arms and legs should swing freely.

Put a toothpick through the holes in the man's hands. This should fit quite tightly.

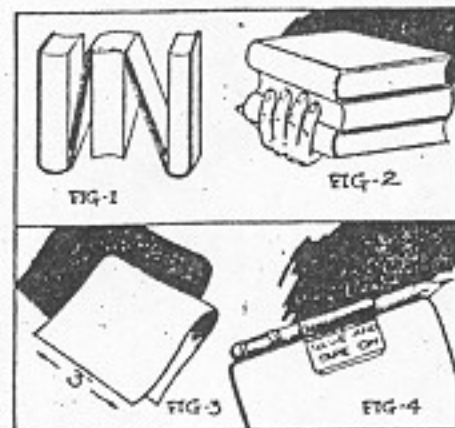
When all this has been done, you will find that by twirling the toothpick between your thumb and forefinger, the man will whirl around as though the toothpick were a trapeze. He will perform as in Figure 5, his legs and body swinging about in a very funny manner.

You can color the man with crayons, too, if you wish.

SCHOOL-EASER IDEAS

How To Carry An Armful Of Books Make A Handy Pencil-Holder

I've noticed that most of my young friends consider the business of going to school is a man-sized job and I agree with them. Furthermore, I think it should be made as systematic and easy as possible, and that's why I want to pass on to you two useful ideas. One is how to carry a whole bunch of schoolbooks so they won't spill out of your arm even when you don't have a strap around them. The other is how to equip each of your books with a handy pencil-holder.



The first idea is explained in the top part of our illustration. To lock your books together, all you have to do is overlap their covers (Figure 1). When you have done so, you can pick up the whole bunch of books with one hand, as in Figure 2. You can carry five, six or seven books this way. Try it.

The pencil-holder idea is illustrated in Figures 3 and 4. You must have a piece of tough brown wrapping paper about three inches wide and five inches long. Fold this over as in Figure 3 and glue the ends of the strip together, leaving an open tube at the folded edge just large enough to slip a pencil into.

When the glue has dried, the holder must be fastened to the inside edge of the book cover. To do this, first glue it in place and then anchor it even more securely into the book by putting some adhesive tape over the tab as shown in Figure 4.

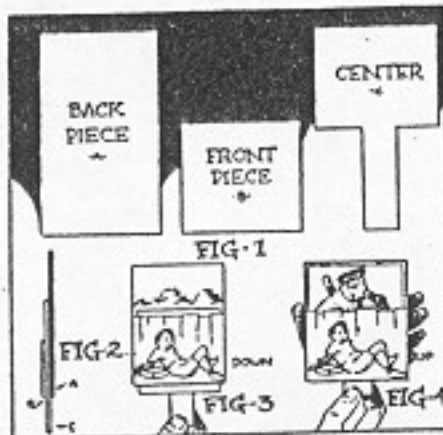
Slip a pencil into the holder and it will always be handy when you want it while studying the book.

SLIDING PICTURE-CARDS

Move A Little Tab And The Scene Changes

Anybody who is handy with scissors and paste can make sliding picture-cards. They are lots of fun to show to others, and make good greeting cards for birthdays.

Figures 3 and 4 show how a sliding picture-card works. Figure 3 shows the card as it appears when you first look at it. Figure 4 shows what happens to the picture



when you push a little tab up at the bottom of the card.

Three pieces of heavy paper or light-weight pasteboard are needed. These are shown in Figure 1. "A" is the back piece of the card, "B" is the front piece and "C" is the center, or sliding portion.

"B," the front piece, must be glued at its two side edges to the bottom half of "A," the back piece. Do not put glue over the entire back of "B"—just a strip of glue at each side edge. Thus, when the glue has dried, there will be a space between "A" and "B" which will allow you to slide "C" between them. The top portion of "C" must be just a little narrower than "B" or "A."

When "A" and "B" have been glued together, draw a picture on them with crayons, pencil or ink as shown in Figure 3, which depicts a schoolboy sitting beside a wooden fence.

Next, draw another picture on "C." In Figure 4, this picture is of a big policeman who is out looking for boys who are playing hooky.

Now, slide the "C" card between "A" and "B," but keep it hidden behind "B." Show the card to a friend. While he is looking at it, shove up the tab on "C," bringing into view the picture of the burly officer.

You can think up many different picture ideas for your cards instead of using the policeman and the schoolboy.

SLAP HANDS

Warm Up Your Hands On Cold Winter Days

When you've been out coasting or skating in winter and your hands are cold, one of the best ways to warm them up is to play "Slap Hands."

One player holds his bare hands out before him waist high, with the palms up. The other player places his hands, palms down, on the first player's hands (see top part of our drawing).



Now the problem is for the first player (whose palms are up) to move so quickly that he succeeds in slapping the tops of the second player's hands before they can be withdrawn.

This requires the first player to drop his hands, whisk them up, turn his palms down and bring them down again, all with lightning swiftness.

Best way for the second player to avoid getting slapped is to watch the first player's eyes, which usually will give an involuntary signal when the player is ready to try to slap.

If the second player avoids getting slapped, it becomes his turn to try to do the slapping. Otherwise, the original position is resumed each time until the slapper misses. Warms you up in jigtime!

ARMS-AND-LEGS STUNTS

Three Of Them For You To Try

Stunts to do with your legs and arms are great sport, especially when some of your friends are around to try them, too. Three good ones are illustrated in our drawing.

One of them is called "Stiff-Legged Sailor" and is illustrated in the top panel. The second is called the "Backward Grasshopper" and the third is the "Camel Crawl."

In all of them you have to be careful, or you'll fall on your noggin!

To do the Stiff-Legged Sailor, hold your arms straight out to the side, balance yourself on one leg and then raise the other leg straight forward without bending the knee of it. After taking that position, try to stoop by bending the knee of the leg on which you are standing. The object, of course, is to do it without toppling over!

The Backward Grasshopper is a little easier. Bend forward from your waist, grasp your ankles with your hands and see if you can hop backwards.

For the Camel Crawl, get down on your knees, reach back, take hold of your feet and raise them from the floor so you are balanced on your knees. Then try to "walk" forward on your knees without letting go of your feet or letting them touch the floor. It's hard to do!

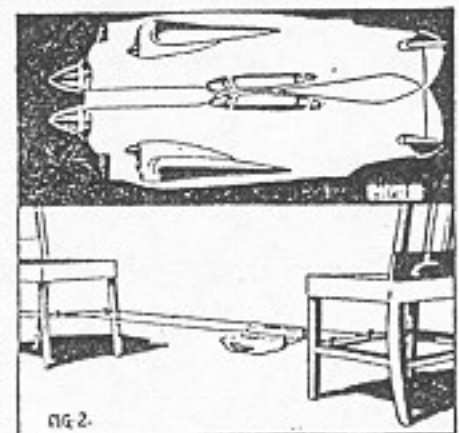


CAPTIVE RACING PLANES

Made Of Paper And Hung On Taut Strings

Boys and girls who like aviation can, by following these directions, have indoor races with "captive" paper planes that "fly" on strings. The planes are called captives because, hung on strings, they cannot get away from you.

First, you must make two planes, one for each player. Figure 1 shows how to do it. For each ship, have a piece of paper five inches square. Fold it across the middle. On one side of the fold draw the outline of a plane. With the sheet still folded, use scissors to cut through both sides along the lower edges of the outline. When the folded paper is opened it will be shaped as in Figure 1. With crayon, draw the features of the plane—wings, propeller hub, etc.—on both sides of the ship. This should be done neatly.



Next, tie two pieces of string, each about eight feet long, to the rungs of two chairs as shown in Figure 2.

Hang one plane by its fold over each string. Use a paper clip or a pin to fasten the two sides together at the bottom so the plane will not leap off the string. Be sure it can slide easily.

Line the planes up side by side at one chair rung. At the word "go" each player plucks his string with his finger as you would pluck the string of a violin. The vibration of the string will cause the captive plane to move. Keep doing this. The first plane to reach the rung of the other chair wins the race. It is not always easy to win, for sometimes the plucking of the string will cause the plane to go backward and sometimes it simply will stand still. Try it! It's fun!

TANK TRAP

Wage A War With Rolling Toys

If you will get a long strip of heavy wrapping paper and two or three toy army tanks, army trucks and similar little vehicles on movable wheels, you and your friends, pretending to be generals, can have a lot of fun playing "Tank Trap." It's a game in which you keep score on a pad of paper, and the first player to get 200 points wins the battle.



The strip of wrapping paper should be 10 or 12 feet long and with crayons of different colors you should prepare it as shown in Figure 1. Use the crayons to lay out the five scoring areas that appear at the top end of the paper. The value of each scoring area appears at its left and right ends. The scoring area marked "Tank Trap" is worth 5 points; "Air Raid," 10 points; "All Clear," 15 points; "Retreat" is worth only 5 points; and "Enemy Routed" is worth 25 points. These scoring areas should extend, as shown, from one side of the paper to the other and should be about six inches wide.

Spread the prepared paper on the floor and, to keep it from rolling up, weight it along its edges with small objects. Give each player his choice of one miniature vehicle—a toy tank on wheels, a toy auto, a toy truck or similar thing that can be rolled. The players take turns rolling their vehicles, starting at the blank end of the paper. The object is to roll the tank or auto or truck just forcefully enough to bring it to a halt in the scoring area of highest point-value. If a vehicle straddles the line between the scoring areas, the player is credited with the smallest point-value of the two areas. The first player—or "general"—to score 200 points is the victor, and then a new battle can be started.

NUT BOWL GAME

A Means Of Testing Your Aim

Whenever you have a few idle moments, play a game called "Nut Bowl." The equipment needed is available in every home. Want to try it?

Get a big pan—a dishpan is perfect—and then get a smaller pan which is not any higher than the dishpan and, preferably, not as high. Place this inside the dishpan.

Thirdly, you must have a tin cup. Put this inside the second pan. The assembled containers will appear as in Figure 2. Place them on the floor.

There can be two or more players. Give each one three nuts—walnuts or hickory nuts, for example—or three empty thread spools.

Establish a taw-line about 10 feet from the pans. The players stand at that line and take turns tossing the nuts or spools at the pans to see who can get the highest score. If a nut falls into the dishpan, the player gets 5 points. If it falls into the smaller pan he gets 10 points. If the nut goes into the tin cup (which is hardest to hit) he gets 15 points.

The player who gets 30 points first wins.



CUP BALL

You Catch A Paper Ball In A Tin Cup

Want to have some fun in a hurry?

The equipment is easy as pie to assemble and the game you play with it is loads of fun.

You will need a tin cup, some string and a wad of paper or an empty thread spool.

If you wish to use the wad of paper for a ball, instead of the empty spool, prepare the wad as in Figure 1, wrapping it tightly with some strong string.

Tie this wad to a piece of string five feet long. Tie the other end of the string to the handle of the tin cup. The cup-ball equipment is now ready to use.

There can be two or more players for a game. Each player gets three turns to see how many times he can swing the paper ball high into the air and catch it in the tin cup as it descends. Each time he snares the ball in the cup, he gets five points. After he has tried three times, it is the next player's turn. First player to get 115 points is the winner.

If you use a spool instead of the paper wad, simply tie the spool to the free end of the long cord. It's noisier.



MAKE A BEAN RATTLE

A Cardboard Tube Containing Beans, Rice, Nuts And Pebbles

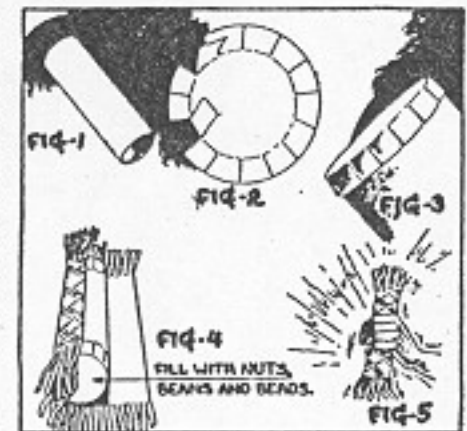
When you're looking for something to make that will disturb the peace and quiet (lots of fun to do that if you can get away with it!), try a bean rattle. It will be noisy enough to satisfy most anybody's desire to set up a racket, and it is also good to use for keeping time with radio music.

Start with a hollow cardboard tube such as paper towels are rolled on. Such a tube is shown in Figure 1. The next step is to make a cover for each end of the tube. Cut a circle of heavy paper that is about one inch greater in diameter than the end of the tube. Place the tube end-up in the exact center of this disc of paper and draw a pencil line around it. Remove the tube from the paper and with scissors cut a series of slits in the paper from the edge to the pencil line (see Figure 2).

Put some glue on each tab made by these slits and then glue the paper over the end of the tube, as shown in Figure 3. A cover for the other end of the tube is made in the same manner, but, before you close up the second end, pour a handful of beans, rice, hazelnuts and pebbles into the tube. Then close up the tube by gluing on the second end.

When this has been done and the glue has dried, you will discover how to make the rattle work. Just shake it and the beans, rice, nuts and pebbles will clatter around inside.

But the rattle is not finished until you have decorated it. A scrap of old wallpaper or some brightly colored wrapping paper is prepared as in Figure 4. The scrap should be trimmed so it will fit around the cardboard tube, with about two inches of excess paper projecting at each end. With scissors, cut the ends into a fringe as shown and then glue the paper around the tube.



CHECKER-PITCH

A Game Board You Can Make And Play With

Checker-Pitch is an easy game to make and fun to play.

You must have a piece of heavy cardboard one foot square, four small wooden blocks about one inch high and a sharp knife.

The heavy cardboard becomes the pitch board and the four blocks of wood hold it up off the floor.

With pencil, lay out seven two-inch squares on the cardboard as shown in Figure 1. After drawing the outlines, use your sharp knife to cut the squares out.

Print a value at each square with pencil, following Figure 1. Beneath the square at the bottom of the diamond print "Add 50." Beside or beneath the two squares immediately above, print "Lose 20." At the square in the middle print "Add 10." Beside the squares above the middle one print "Add 40" and at the top square print "Add 50."

When this has been done, fasten the cardboard to the wooden blocks, tacking one block beneath each corner as shown in Figure 2.

For each player have two or three checkers (Figure 3).

Place the pitch board on the floor about six feet in front of a taw-line.

The players, one at a time, step up to the taw-line and toss their checkers, attempting to aim them so they will go into the "add" squares and not into the "lose" squares or beyond the pitch board entirely.

Each time a player's checker falls into a "lose" square, he must subtract the required amount from his score. If this should happen before he has scored any points at all, he is in the sorry predicament of being minus the required number of points and must therefore strike enough "add" squares in order to make up this minus and get his score into the "plus" column of his tally sheet.

The first player to score 50 points is the winner.

See how many words you can make using only the letters in
REPOSITORY

This word is a noun and means a place for storing things. It is pronounced "ree-poz-ih-tory," with the accent on "poz."

You should be able to make more than 26 words. Can you?

PLAY "STATES"

Next time you have a party at home or at school, give everybody a pencil and some paper and play "States."

At the word "Go," they must begin to write down in a list the names of all the states in the United States.

Stop them when five minutes are up. Give prizes to those who have listed the most states.

You think it's too easy? Try it!

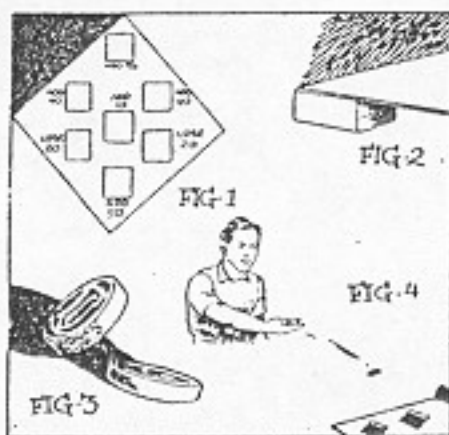
JAW-BREAKERS

Say "toy boat" as fast as you can 10 times.
Little Boy Blue blew his blue bugle.

IN YOUR POCKET

This is fun for boys and girls to play. Each player empties everything from his pockets (or purse) and counts all the articles, no matter what they are—string, marbles, pins, pencils, erasers, paper clips, knives, slingshots, or what.

The player who has the greatest number of articles wins.



PASTEBOARD DANCER

An Amusing Animated Toy

Make a dancing doll out of cardboard.

Out of a lightweight piece of cardboard cut the figure of a man or woman or boy or girl. Make it about three inches high. There should be no legs on the figure—just the upper part of the body (Figure 1).

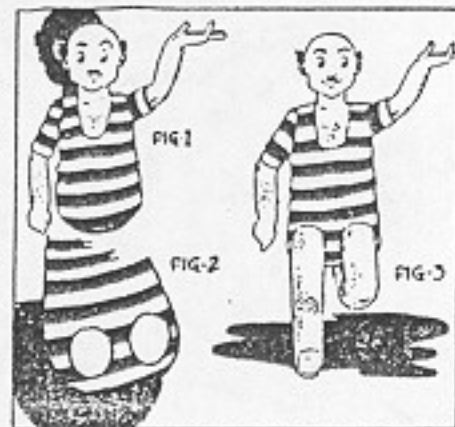
Color the figure with crayons or paints. If you wish, you can color your first ones simply with pencil. After you have learned the knack of making the figures, you can color them more elaborately. Draw the face with pencil or pen and ink.

Near the base of the figure make two round holes side by side (Figure 2) and just big enough to get your first and second fingers through.

Next, put your fingers through the holes to represent the legs of the figure (Figure 3).

You will discover that you can move your two fingers easily and so, with no difficulty at all, you can make the cardboard figure appear to walk, dance, jump, stumble and otherwise perform in an amusing manner.

Make half a dozen different dolls and put on a show for your friends. They'll want to make some for themselves.



MAKE-UP TRUNK

Into It Put Things To Wear In Your Shows

If you like to act and put on amateur shows, or if you just like to "dress up" in funny costumes, start a make-up trunk.

This trunk, which is really just a medium-sized packing box, can be a fascinating thing because in it you can store away all kinds of stray bits of costuming that will come in handy when you and your friends get yourselves up as heroes, heroines and villains.

All that is needed is a fairly sturdy box with a lid. Into it put any old clothing that Dad or Mother or your aunts and uncles will let you have for theatrical purposes. Our illustration suggests some typical articles such as a couple of old, battered hats, a pair of worn-out shoes that are much too large for you and therefore will look funny when you put them on, a false moustache, a pair of old spats (also too big for you), an old, broken cane, some ragged neckties, some old trousers, etc.

A girl can put away some old-fashioned hats given to her by her aunts and some old-fashioned dresses and some old-fashioned high-heeled slippers, and she might also have a funny wig made out of shredded rope.

All these things can be accumulated in a period of a few weeks or months. You probably will have only a few articles at the beginning, but bit by bit you will increase the number until some day your make-up trunk will contain pretty nearly any piece of costuming you might want when pretending to be a great actor or actress.

Your make-up trunk will be lots of fun on stormy or wintry days.



RATTLING BONES

Two Pieces Of Wood Become Fascinating Rhythm-Makers

Probably few boys and girls who are reading this book have ever seen an old-fashioned minstrel show. In those shows the funny "end-men" always had, as part of their equipment, a pair of "bones." Holding the bones in his fingers, the end-man could make them rattle in such a manner that he could keep time with music and fascinate his listeners with the rhythm. The two flat little pieces of bone or hard wood between his fingers would sound like a castanet and also would resemble the rhythmic beat of a tap-dancer's toes.

It's easy to make a pair of these "bones."

You need two pieces of very hard wood, each six inches long, about one inch wide and three-sixteenths of an inch thick. Whittle the wood so that it is smooth (Figure 1). A thin foot-long ruler cut in half at the six-inch point will do nicely.

Figure 2 shows how to hold the "bones" near the top between your fingers—one between the first and second fingers and the other between the second and third fingers. The "bones" should be gripped tightly enough by your knuckles to keep them in place, but loosely enough for the lower ends to touch and rattle when you shake your hand from side to side with a rocking movement of the wrist.

Try a gentle shake at first to be sure the "bones" are being held loosely enough to clatter against each other. Then shake your hand more vigorously from side to side. Keep doing so and you will discover that it is possible to rattle the "bones" rhythmically as long as you wish.



PLASTER-BLOCK STATUES

A Sculpturing Fun-Project

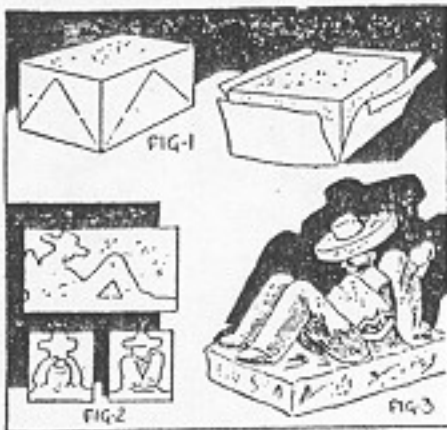
Plaster-of-paris sculpture is great fun for boys and girls, whether they know anything about sculpturing or not. Want to try it?

Decide, first of all, the kind of little figure you would like to carve out of a block of plaster-of-paris. Select something easy and avoid any figure which has any portion of it projecting horizontally and unsupported more than about an inch, because the plaster may break and spoil your work. Choose some solid figure.

In our illustration is suggested a Mexican taking his afternoon nap (Figure 3). The figure is solid because there is not much of it projecting horizontally excepting the brim of the hat. Thus there is little chance of any part of the finished statue breaking off.

When you have decided upon a figure, you will have an idea of the shape of plaster block you will need. Find a cardboard box of about that shape and size. In this you will mold the block which will later be carved.

For a few cents you can buy enough plaster-of-paris at a hardware store. At home, mix it with some water. It should be made thick and not watery. Pour the wet plaster into the



cardboard box and let it stand overnight. The next day it will be hard and ready to remove from the box. To do this, simply break the sides of the box away from the plaster (Figure 1).

Next, with your model in mind, make some pencil lines on the sides, top and ends of the plaster block to guide your pocketknife when you start carving (Figure 2). Then, with the point and blade of your knife, begin shaving the plaster away. Keep on until you have carved the complete figure.

When the carving is finished you can paint the figure and finally give it a coat of shellac.

After you have made one statue and learned how to do it, you can make others. Your friends will like them as gifts. They make dandy paperweights, for one thing.

MIND-READING

It Will Mystify Your Audience

Boys like to show how good they are as mind-readers, and a dandy stunt for them to try is one that requires two confederates and one or more "victims."

One confederate leaves the room. The other asks one of the victims to point out some object he wishes the absent boy to identify upon his return. The "victim" is told to concentrate his thoughts on the chosen object.

The boy who left the room is summoned back. His confederate proceeds to question him, pointing to various objects and asking, "Is that the one selected?"

The "mind-reader" keeps saying "No" until suddenly he says "Yes," and, behold, he has correctly identified the chosen article!

The secret is this: Whenever the confederate who remained in the room points to a black object, the next object he points to will be the one that should be identified.

Try this out at school.



NUTSHELL ANIMALS

They Have Toothpick Legs, Paper Ears And Tongues

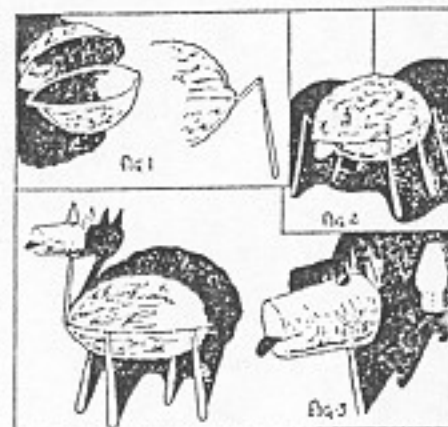
English walnut shells can be turned into all kinds of weird animals.

A shell can be opened without cracking it if you insert a knife-blade between the halves and pry gently. Scrape out the nut meat.

With glue and some toothpicks you can then make the strange-looking bug shown in Figure 2, the horse in Figure 3 and many other models.

Figure 1 shows where to crack a toothpick and how to glue it between the halves of the shell to make the bug's legs. A piece of red paper glued between the halves is a tongue. Spread glue around the edges of the shell and, with the cracked toothpicks in place, let the shell rest on its back until the glue has dried.

The walnut horse is made in about the same manner, except that instead of cracking each toothpick twice as for the bug, you crack it only once. The horse's neck is a toothpick, one end of which has been inserted into a small slit in a little cork, which becomes the horse's head. A piece of red paper makes a tongue and two pieces of white paper (Figure 3) glued to the cork are ears.



BOUNCING-BALL GAMES

"One Bounce" And "Six Ball"

Here are two excellent bouncing-ball games that can be played outdoors or, when the weather is bad, indoors.

Both games are illustrated in the diagram.

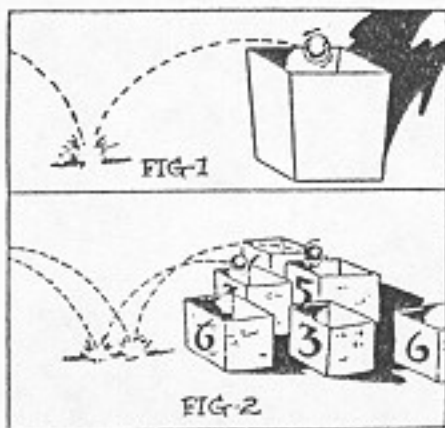
The top part of the picture, Figure 1, shows how to make a game called One Bounce. The only equipment required is a wastebasket and a tennis or rubber ball.

Place the basket on the ground or floor. Then take a position 15 feet away from it. Toss the ball to the ground near the basket in such a manner that it will bounce once and go into the basket. Each time a player gets the ball in the basket he scores one point. If the ball bounces more than once before entering the basket—even on the rim of the basket—it is not counted. Players take turns. First one to score 12 points wins.

The other game, illustrated in Figure 2, is Six Ball. Have three tennis balls for each player. Arrange six boxes as shown in the diagram. Each box is worth a certain number of points. Those at the three corners of the triangle are worth six points each. Those in the second row are worth three each and the one in the center of the back row is worth five points.

Each player tosses three balls, one at a time, as his turn. Each ball must bounce once and then go into one of the boxes in order to score the value of that box. Then it is the next player's turn to toss three balls. The first player to score 50 is the winner.

The boxes can be set near a wall and, if you wish, you can let it be a rule that if the ball bounces once in front of the boxes, next bounces against the wall and then into one of the boxes, it will count.



BOUNCING SOAP BUBBLES

Give A Performance For Your Friends

Some young friends of mine were going to have a show and they asked a boy and his sister if they would take part. The boy answered, "We'll be glad to and we'll do our soap-bubble act."

The boy and his sister are expert soap-bubble-blowers and they have worked up a five-minute act that other boys and girls can easily perform if they know the secret of blowing bigger and better bubbles. You can even juggle soap bubbles, actually bouncing them up into the air and back and forth between yourself and someone else. This always amazes people, because the experience of most boys and girls is that when you touch a bubble it immediately bursts.

Of course, even these specially made bubbles eventually do burst, but they are stronger and bigger and last longer because—and here's the secret of their success—you add a few drops of glycerine (Figure 1) to the soapsuds. Furthermore, when you want to touch a bubble with your hands without breaking it, do it very gently and only when wearing soft woolen gloves (Figure 2).

Why not try it? It's a lot of fun when you have to stay indoors and, with practice, you can soon learn enough stunts with bubbles to make up an act for a show.



OFFICE DESK

Two Crates And Some Plank Are All You Need

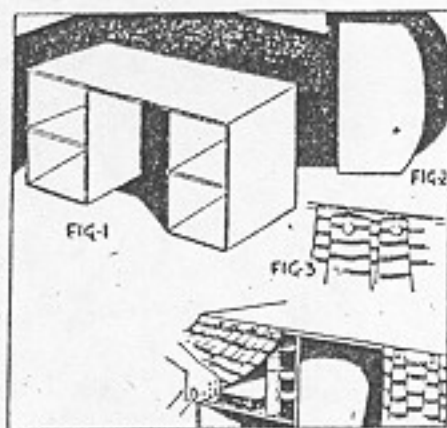
Every big business man has a desk at which to work and every boy and girl who likes to pretend he or she is head of a big business should have a desk, too. Here is how to make one out of a couple of orange crates and a board.

The orange crates serve as the ends of the desk. The partition in each crate makes a fine shelf for papers and books (Figure 1).

For the top of the desk, have a long board of hard wood. It can be oblong or can be cut with a curved side, as in Figure 2. The board should be planed and sandpapered so it will be smooth.

Curtains of bright cloth can be tacked across the open sides of the orange crates. The way to do this is shown in Figure 3. The curtains will hide any books or papers you put on the shelves. The desk can be varnished to give it a good finish.

If one long board isn't wide enough for the top, fasten two boards together with strips of wood underneath at the ends.



SCHOOL PARTY GAME

Players Guess What The Sounds Represent

Looking for a good game to play in school or at a party? Try "I Dropped It." It's great fun.

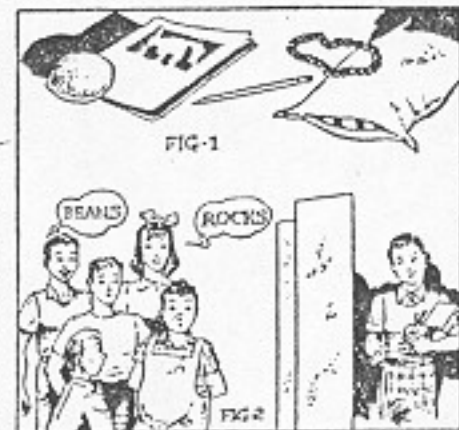
First thing to do is round up a lot of different articles—an orange, pencil, pillow, string of beads, book, walnut, knife, fork, pan, ruler, etc. Have 20 or 30 different things. These are the articles you will drop on the floor behind a screen or a partly closed door. The object of the game is to see which of the players on the other side of the screen can guess the greatest number of articles dropped, with only the sound of them striking the floor as a clue.

Figure 1 shows a few of the articles you can use. Figure 2 shows how the game is played with the dropper on one side of a screen and the other players—guessers—on the opposite side.

Give each of the guessers pencil and paper. On each sheet of paper have a number of lines drawn and number them 1, 2, 3, 4, etc. If you intend to drop 20 articles on the floor, there should be 20 numbered lines on each sheet. If you will drop 30 articles, there should be 30 lines.

In advance of the game, the player who will drop the articles should prepare a similar sheet of paper, listing by number the articles he will drop. The pillow, for instance, can be No. 8. The necklace can be No. 1, the book No. 3, etc.

With this chart beside him, the dropper takes up his position behind the screen and the game begins. Before he drops each article, the dropper should call out its number according to his own chart. Players then must try to guess what the article is and write its name on the proper line of their papers. Player who guesses the most articles correctly is the winner.



PAPER POTTERY

Make A Hot-Plate Pad

Paper pottery is popular among boys and girls who like to make useful things. One article that can be made and given to Mother is a hot-plate pad.

Paper pottery is made with serpentine—those long, narrow strips of paper people throw at New Year's Eve parties. It can be bought in stores, several rolls costing but a few cents. Select four or five different colors to use in making the hot-plate pad.

Start with one roll and rewind it very, very tightly. When you reach the end of the roll, select another roll of a different color. Glue the ends of the two rolls together (Figure 2) and continue winding as in Figure 1. Add a third roll and a fourth and a fifth in the same manner (a different color each time) until the combined rolls have attained a diameter large enough to set a hot plate or pot on. Then glue the tail end of the last roll to the roll itself.

If you have rolled the paper quite tightly you will find you have made a large, solid, rainbow-hued disc (Figure 3).

Shellac the disc. When it is dry it can be used to set hot dishes on as in Figure 4.

Why not make two or three of these holders for Mother and some for your aunts, too? They'll be grateful for them.

FUN FOR GEOGRAPHY FANS

A Game Played With A Map

"Find It" is the name of a fine home-made game that is great fun for boys and girls who like geography. If, after trying it, you find it enjoyable, you may want to suggest it to your teacher as a game for your classroom.

All you need is a map of the United States, or of Europe or of any other continent or country in the world.

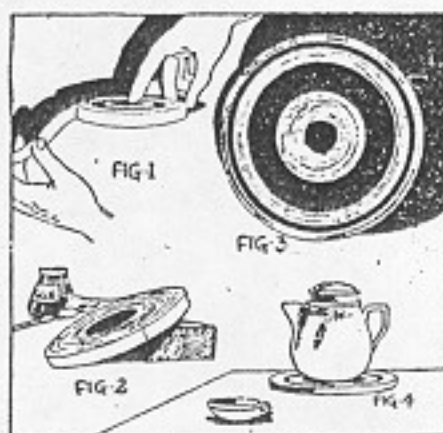
Spread the map on a table. The players should sit opposite each other at this table as the boys in the upper half of the illustration are doing.

Decide which player will start the game and then begin. The starter looks at the map and selects some city. He must not point to it or otherwise give his rival any idea of where the city is located. He simply says, "Try to find Boolaboola," or whatever the city's name may be.

It is then up to the other player to study the map until he finds Boolaboola, or until he gives up. If he gives up, he loses one point. If he finds it, he scores one. Either way—whether he finds it or gives up—it then becomes his turn to select a city and ask the first player to find it. This player either scores a point or loses a point, depending upon whether he finds the city or gives up.

Have a watch or a clock on the table. Allow each player three minutes to find a city. If he doesn't find it within that time, and doesn't give up, he automatically loses a point.

The first player to score five points is the winner of the game.



HALLOWE'EN CAN-RATTLE

Three Tin Cans, With Pebbles In Them, On A Rope

Hallowe'en and noise go hand-in-hand, so here is how to make a dandy noise-maker to hang on your front porch.

It's a huge rattle made of tin cans and rope, with a handful of small stones in each can. Whenever you want to make some noise, all you have to do is to go out on the porch, grab hold of the rope and shake it. The pebbles in the cans will do the rest. If you are having a party, you, as host, can greet each guest by shaking the rattle.

You should have at least three large cans—coffee containers will do—and each one must have a removable lid. Punch a hole in the middle of the bottom of each can and in the middle of each lid. These holes must be large enough to slip a rope through. The rope should be as thick as a piece of clothesline and about five feet long.

String the cans and lids upon this rope, one at a time. Tie a knot in the rope outside the bottom of each can (Figure 1). This will keep the can from slipping down to the bottom of the rope. Be sure to thread the lid of each can onto the rope before putting on the next can. Then, about six inches farther along the rope, tie a knot to support the next can.

After the cans and lids have been strung, put a handful of small stones in each can and put the lid in place.

When this has been done, hang the rattle up on a porch beam. To use it, grasp the tail end of the rope as the boy in Figure 2 is doing and shake the whole contraption.



SECRET HIDING PLACE

You Make It Out Of An Old Book

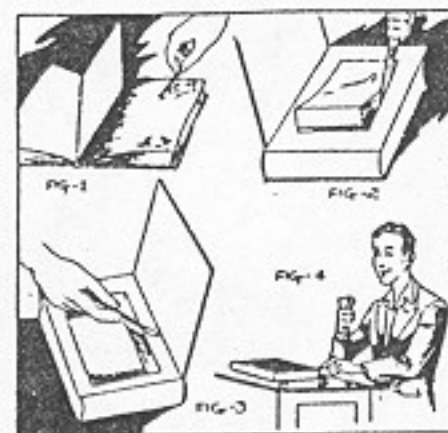
If you belong to a club that needs a place in which important papers can be safely hidden, make a secret book. It's a good hiding place for small articles. When it is placed on a table or shelf with other books, no one would likely suspect it contains anything but ordinary pages.

All you need is an old book nobody wants any more and some glue. The pages of the book must be glued together and then an oblong hole must be cut through them. This hole becomes the receptacle for things to be hidden.

Be sure the book you choose is no longer useful. To be on the safe side, get permission from Mother or Dad to use it.

Figure 1 shows how to glue the pages together. The glue is applied only around the three loose edges of the pages. The first 15 or 20 pages of the book should not be glued together. Allow them to be loose as in an ordinary book. Glue all other pages, however, and the last page should be glued to the inside of the back cover of the book.

Figure 2 shows how to use a sharp knife to cut the oblong hiding place in the glued pages. Figure 3 shows how you can use water colors to paint the inside of the book if you wish to do so. Figure 4 shows the completed book, out of which the boy has just removed some important papers he had hidden there.



A GHOST FOR A PARTY

Pictures Move, Rugs Wiggle And Books Fall

Any boy or girl who is going to have a Halloween party (or a birthday party) can have lots of fun with this ghost stunt.

It enables any young host or hostess to astonish his or her guests by making pictures, rugs and books move about on the wall, table and floor, seemingly of their own accord. A picture that has been hanging straight on the wall suddenly moves into a cockeyed position. A small rug on the floor suddenly starts to slide to one side and a book resting quietly on a shelf suddenly begins to quiver and finally falls with a crash to the floor. The effect is nothing short of amazing!

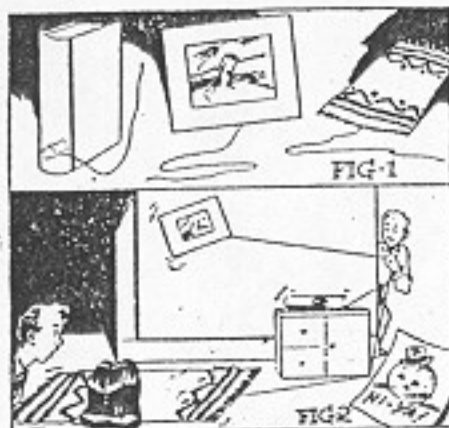
It's all done with black threads.

Black thread is one of the stand-bys of all magicians, for it is hard to detect from a distance of six or eight feet, and is especially easy to conceal if the room is not brilliantly lighted.

Sturdy threads can be attached to books, pictures and small carpets as shown in Figure 1.

When these objects have been placed in their proper places in the room before the guests arrive, the threads should be loosely run to a central point just outside a doorway where the operator of them will hide when it is time for the trick. As shown in Figure 2, it is easy enough for the operator to tug on the threads and cause the objects to move as though by ghostly hands.

If an object is so heavy that one thread is likely to break when you try to move it, twist two or three-lengths of the thread together. As a further word of caution: Remember that a small rug will slide more easily across a wooden floor than across a carpet.



MAGNETIZED HAIR-RAISER

A Piece Of Newspaper Performs Wonders

Here is how to magnetize a piece of paper and have some fun. When the paper has been magnetized, it can be used to make hairs on a friend's head stand up and it will cause little scraps of paper to jump into the air, stand upright on a table top or even cling to the magnetized paper itself.

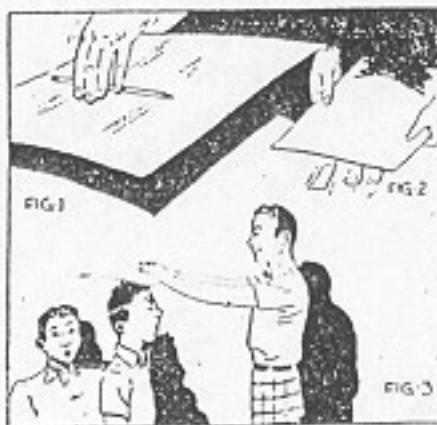
It's all done with a pencil. The best kind of paper to use is a piece torn out of a newspaper. It should be a section about a foot square.

Place this square on a smooth, hard surface. The magnetizing process is shown in Figure 1. Just rub the paper hard and briskly for about three minutes with the side of the pencil.

When you believe you have rubbed the paper enough, quickly lift it off the table and hold it horizontally about an inch above the head of a friend, as in Figure 3. If the paper has been properly magnetized, some of the hairs on your friend's head will rise.

If pieces of paper about as big as a penny are spread on a table, the magnetized paper will cause them to perform amusingly when it is held about an inch above them.

The paper will have to be magnetized after each demonstration and from time to time a new square should be used.



ACORN JEWELRY

An Attractive Necklace And Bracelet

Out of acorns a dandy bracelet and a necklace can be made.

Find some acorns of reasonable size. They should have their caps on them, as in Figure 1. You can also get some colored beads which are shown in Figure 1, too.

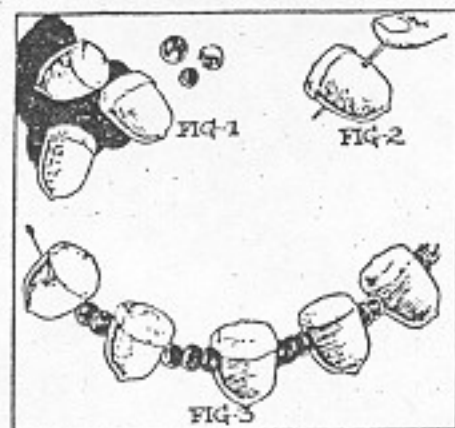
The next step is to pierce each acorn from side to side (Figure 2). This can be

done with a darning needle and a nail. First make a hole through the acorn with the darning needle, being careful not to crack the acorn shell when pushing the needle through. Then, to make the hole a little bigger, gently push a small nail through it. Be careful as you work or you will cause the cap to drop off the acorn.

Prepare enough acorns this way to make a bracelet and a necklace.

The third thing is to string the acorns on heavy cord or yarn. Colored yarn is good to use. Thread the cord or yarn on the darning needle and pass it through the holes in the acorns. Figure 3 shows how the colored beads can be strung between the acorns to add color to the general effect.

When all these things have been done, you will end up with a beautiful necklace and bracelet that any girl will be glad to wear.



HOW TO CARVE A FACE

A Wood-Carving To Hang In Your Room

Boys and girls who would like to try a hand at easy wood-carving will enjoy this fun-project. By following the directions, anyone, almost without practice, can carve an attractive wooden picture which can be hung on the wall.

You need a sharp-pointed knife, a piece of soft plank and a magazine picture, preferably of a person's head or of an animal. Profile pictures are best.

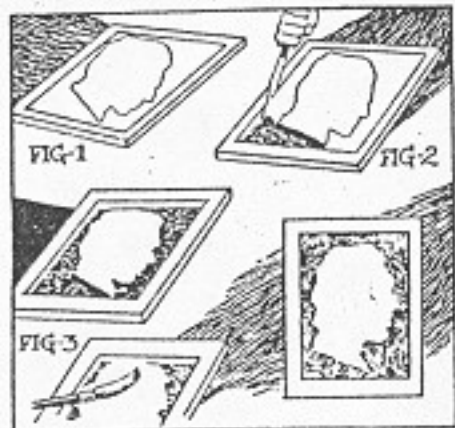
Cut the picture out of the magazine, following the outline of it accurately with your scissors. Spread glue over the back of the picture and then press it into position upon the surface of the wood. Figure 1 shows such a picture in place.

With a ruler draw a line around the plank to designate that portion which will become the frame for the picture. With the point of your sharp knife, make a deep cut along this line (Figure 2) and also make a deep cut around the edge of the picture glued on the wood.

When these cuts have been made, use the point of the knife to chisel and chip away the wood between the outline of the picture and the deep line at the edge of the frame (Figure 2). The wood should be chipped out about one-eighth of an inch deep.

When you have finished chipping, you will have a wooden plaque that looks like the one in Figure 3. The frame and the picture will be the full thickness of the wood, but the space between the picture and frame will be depressed because you have chipped the wood away.

You can sandpaper the magazine picture off the wood and then stain the whole thing. It can be hung on the wall if you drive a small tack into its back and attach a piece of cord.



MOVIE GAME

Stars' Faces Become Jigsaw Puzzles

Boys and girls who like movies will enjoy making and playing the Game of Movie Stars. The outfit is easy to assemble. It's perfect for a party.

Out of a magazine clip a big picture of a movie actor or actress. Spread glue over every inch of the picture's back and glue it to cardboard. After the glue has dried, use scissors to cut the picture into jigsaw puzzle parts as shown in the illustration.



Put all the parts into an envelope.

Next, cut some one-inch squares of cardboard. Print the actor's name on these squares—one letter on each square. Place these in the envelope with the jigsaw parts.

On some more squares of cardboard print the letters of another actor's name. Whenever possible, use the name of an actor who might be mistaken for the one in the puzzle picture. This second name is for the purpose of confusing a player.

Put the second set of name-squares into the envelope with the first name-squares and the jigsaw picture.

Prepare as many such envelopes, each containing a different actor's picture, as there will be players in the game. One envelope is given to each player.

At the word "Go," players dump out the contents of their envelopes and start to assemble the puzzle pictures. When that has been done, they then assemble the two sets of name-squares. Each player must decide which name properly identifies the actor in his picture and must discard the other name-squares.

The player who is first to finish assembling his puzzle picture and identify it correctly is the winner.

Because you made up the puzzle envelopes and know the identity of each picture, you should act as judge of the contest.

WALNUT-SHELL NAVY

It Cruises Across The Bathtub

With very little work you can build a bathtub or dishpan navy out of English walnut shells. It's lots of fun to make the fleet and sail it.

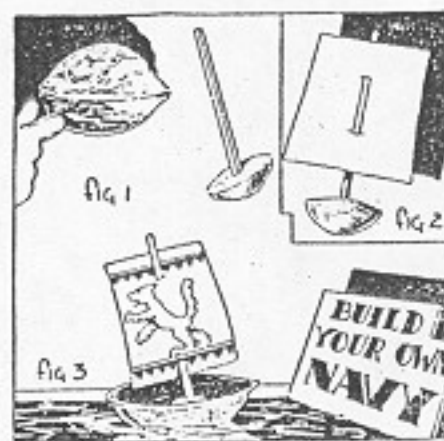
Each boat has a paper sail. By blowing on the sails, the boats can be made to move about in the water. There can be imaginary ports to which the boats sail and, by rippling the water, there can be a storm at sea.

Carefully crack an English walnut by wedging a knife-blade between the two halves (Figure 1). Scrape one half the shell clean inside.

Next, cut a small piece off a cork to serve as a base for the mast of the ship. Stick a toothpick into this piece of cork. Cover the round portion of the cork with glue and fit it snugly into the bottom of the walnut shell (Figure 3).

Cut a small sail out of paper. Decorate it with a design that suits your fancy and then thread the sail on the toothpick mast as in Figure 2.

When the glue has dried on the base of the mast, fastening it securely into the shell, the boat is ready for the water. To make it move, simply blow on the little sail.



HOME BROADCASTER

Produce Your Own Radio Programs

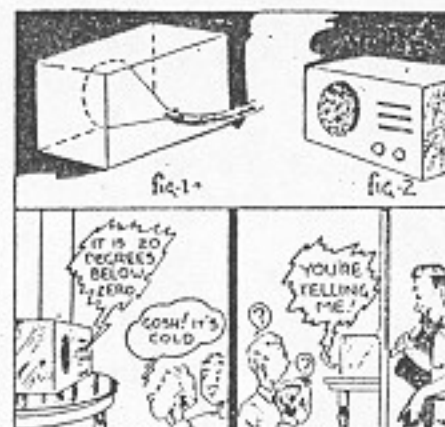
How would you like to have your own "broadcasting station"? The plan is quite simple.

Actually, the station is a fake, but that doesn't detract from the fun. All you need is an old radio cabinet (or a cardboard or wooden box that can be fixed up to look like one), a length of garden hose and a tin funnel.

Attach the funnel to one end of the hose as shown in Figure 1. Fasten the funnel inside the cabinet so that the big end of it is close against the grillwork intended for the original loudspeaker. If a cardboard or ordinary wooden box is used, cut a round hole in one side and glue cheesecloth over it for the grillwork, thus hiding the funnel. The finished "radio" will appear as in Figure 2.

Place the box on a table pushed against some door drapes. The garden hose should project through the drapes. To "broadcast," simply go behind the drapes and talk into the hose as the boy in our sketch is doing. Your listeners on the other side of the drapes will hear your voice coming out of the loud speaker quite clearly.

A varied program can be broadcast if you have someone who can play the harmonica, someone who can whistle, someone who can make good wisecracks and someone who can be the announcer.



DOLL APARTMENT

You Can Rearrange The Size Of The Rooms At Will

Here is an easy way for a girl to make a modern apartment for her dolls to live in, or a boy to make for his sister.

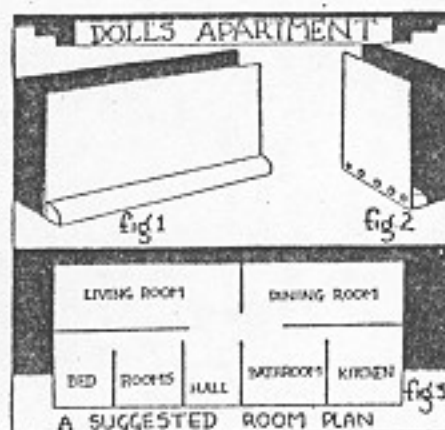
Some cardboard is necessary. This can be obtained by cutting up shoeboxes, or it can be heavy wallboard, some of which Dad may have on hand. If wallboard is used it should be cut into fairly long strips six or eight inches wide.

Next, you must have some pieces of wood. Wood that Dad calls quarter-round will do, but, if none is to be had, strips of ordinary wood an inch or more square will do nicely.

Cut the wood into lengths as long as the pieces of cardboard you have. If a piece of cardboard is a foot long, you must have a piece of wood also a foot long because the cardboard will become a part of the wall of the apartment and the wood is the base that will hold the cardboard upright. Tack the cardboard to the wood as shown in Figures 1 and 2.

If you have 20 to 30 pieces of cardboard prepared in this manner, you can easily stand them side by side to make the walls and the rooms of a doll apartment. You can have any kind of a room-plan you wish and you can change the plan as many times as you like simply by moving the walls around. If a bigger living room or a bigger bedroom is desirable, the walls can be changed accordingly.

Figure 3 suggests one floor plan. A clever boy or girl can figure out many others.



A BED FOR YOUR PET

Will Make A Big Hit With Your Dog

A Kitten Would Like One, Too

Want to make a bed for your dog or cat? It is easy to do if you are handy with a hammer and saw, and it will make a big hit with your pet.

The bed consists of a platform on short legs, with sideboards on three sides of it. A piece of carpet or a soft cushion placed on the platform completes it, and Fido or Tabby will soon discover it's an ideal place to sleep.

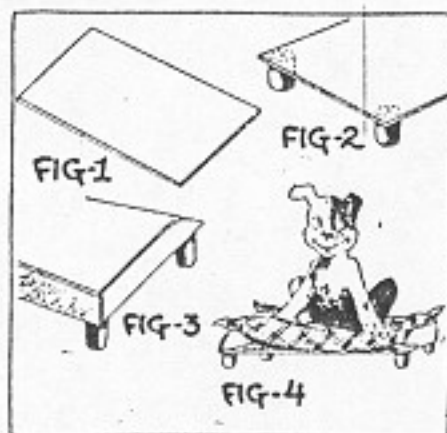
For the bottom of the bed—the platform—you can use a piece of plywood. It should be long enough and wide enough for your pet. A bed for a cat, for example, need not be as large as one for a big dog.

The sides for the bed can be sawed out of plywood, too, or ordinary thin lumber. Figure 3 suggests that the front ends of the sides be rounded. This can be accomplished with a scroll saw or a plane.

Figure 2 shows how to put the short, stubby legs beneath the bed. These can be pieces of broomstick, cut to equal length, or can be small square blocks. Just be sure they are equal in height, so the bed will not wobble when your pet steps on it. If your dog is big and requires a very large bed, put legs not only at the corners, but also at several places near the middle, so it won't sag with his weight.

Figure 4 shows the completed bed with Fido occupying it and looking mighty pleased.

When the bed has been finished, you can paint or varnish it.



See how many words you can make using only the letters in
INTELLIGENT

This word is an adjective, is pronounced "in-tel-ih-gent," with the accent on "tel," and it means sensible.

You should be able to make more than 26 words. Can you?

A FINGER DRAGON

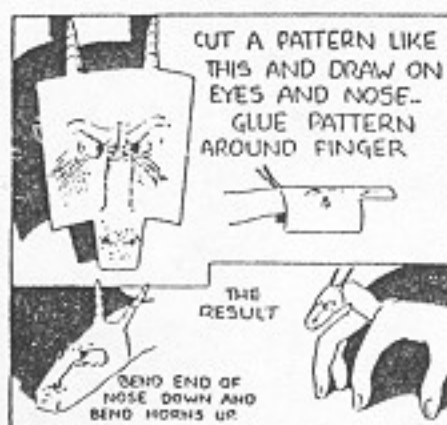
Paper, Pencil And Glue Make A Fierce Monster

With a piece of paper, a pencil and some glue you can turn your middle finger into a very fierce dragon.

You must have an oblong-shaped piece of paper wide enough to wrap around your middle finger and long enough to extend from the first knuckle to one inch beyond the end of the finger.

Cut the paper as shown in the upper left-hand corner of the illustration. Two tabs at the top can be twisted to make horns. With pencil draw fierce-looking eyes and a nose. Draw the nostrils on the lower tab of the paper.

To fit the head to your finger, wrap the paper around as shown in the upper right part of the drawing. Glue the edges of the paper together. Next fold the nose flap down and glue it. The dragon's head will then look like the one in the lower left-hand corner. Raise your finger and the dragon will appear as in the lower right-hand corner.



SANTA CLAUS SPOOL

Save Christmas String And Ribbons

If you like to collect string, you can have lots of fun saving the fancy ribbons and cord taken from the Christmas packages you and your family receive.

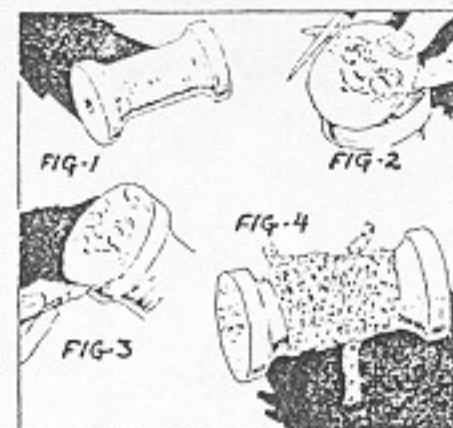
The one big difficulty always has in keeping their odds and ends of cord from becoming hopelessly entangled and therefore virtually useless when some of it is wanted for a fun-project which requires string. If lengths of string are just piled together in a box, they always get tangled up. You must wrap them around something in a neat, orderly manner, or wind them into a ball.

The best way to keep fancy Christmas cord, which deserves special treatment, is to wrap it around a spool and, because the strings and pieces of narrow ribbon are always gay for the holiday season, the spool should be equally typical of the Christmas spirit.

Get the biggest empty thread spool you can find (Figure 1). Out of a magazine cut two colored pictures of Santa Claus. These should be of such a size that, when trimmed into a circle (Figure 2), they will fit perfectly upon the ends of the spool. If you wish, you can use pictures of holly wreaths.

After cutting out the pictures, put glue on the back of them and fasten them to the spool, as shown in Figure 3.

When the glue is dried, the spool is ready to use and the Christmas string is wrapped around it as in Figure 4.



HALLOWE'EN LANTERN

A Tin Can With A Grinning Face

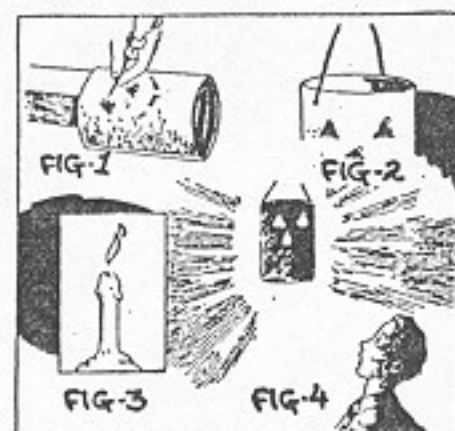
When Hallowe'en comes around, make a tin-can pumpkin face. It can be carried around on a long wire handle. A lighted candle can be put inside it, but be very careful to keep it away from anything that might catch fire.

A discarded can such as a coffee container is the best kind to use. With a hammer and nail, punch openings in the side of it to represent eyes, nose and mouth. This is easy to do without bending the can if you slide its open end over a two-by-four (Figure 1) held tightly in a vise so that it will not move when you hammer on the nail.

The handle can be attached to the can as shown in Figure 2. This handle should be a long piece of wire fastened into two holes near the top of the can.

The candle is put into the bottom of the can as shown in Figure 3.

Figure 4 shows the effect of the tin-can pumpkin face. With the permission of Mother or Dad it can be hung up on your front porch on Hallowe'en so that passers-by can see it. But put it there *only* with the permission of your parents. Furthermore, if you carry the face by the wire handle, be *very sure* the lighted candle gets near nothing that might catch fire. As protection, you can put the lid on the can after the candle has been lighted, first punching some holes about as large as a dime in the lid to provide sufficient air to keep the candle aflame.



HAND-SHADOW FUN

Hold Your Hands Between A Light And The Wall

BILLY, THE GOAT



Place your right hand over your left. The little finger of your left hand makes Billy's beard, which you can waggle. Move the third finger of your left hand and he will chew grass.

CHIEF TWO-FEATHERS



He's very easy to make and you can cause him to move his chin by moving ever so slightly the little finger of your left hand.

KING OF THE BARNYARD



You can put action into this old rooster by opening and closing the first finger and thumb of your left hand. He'll appear to be eating corn.

OLD LADY WHO LIVED IN THE SHOE



She will appear to be talking if you separate the second and third fingers of your right hand slightly. Another funny effect can be had if you move the little finger of the right hand, causing her chin to wobble.

THE STATELY SWAN



Your left hand and forearm are the swan's neck. Your right hand forms the tail feathers. By lowering the left hand and arm you can cause the swan to dive its head.

GIANT BUTTERFLY



You can make this hand-shadow in a jiffy. If you move both hands forward and backward the butterfly will appear to be flying.

THE FUNNY BUNNY



You can make his ears wiggle by moving the fingers of your right hand. He will scratch his nose if you move the first and second fingers of your left hand.

ANOTHER CARROT-EATER



This rabbit will appear to be eating something—probably a carrot—if you bunch together the fingertips of your left hand and move them slightly.

RACE HORSE



This race horse is resting in his stall in the stable because, by moving the little fingers of your two hands, you can make him appear to be eating his hay.

FARMER'S HIRED HAND



To make him talk about the crops and the number of eggs the hens are laying, just move up and down the little finger of your right hand.

SLY OLD FOX



You can make him seem even more fierce-looking by moving the little finger of your right hand, causing his mouth to open as he howls with hunger.

KING OF THE CIRCUS



The tusks of this big elephant are formed by the first and little fingers of your right hand. Your thumb is his mouth and the second and third fingers are his trunk.

WHITTILING RACE

This is fun when a boy's pals get together with their pocketknives. Give each one a stick of the same size—one inch square and 10 inches long is a good size. Soft wood will serve best, being easy to cut.

At the word "Go," everybody must begin to whittle, to see who will be the first to whittle his square stick into a smooth, round one.

JAW-BREAKERS

Say this as fast as you can 10 times: Freckled-face Florence
Simple Sammy sold Sylvia sassafras sauce on Saturday.
Winsome Winnie wondered wistfully,
Shaving Sam saves six cents a shave,
Brush Bob's brow back.
Hungry Harry's homely uncle.
Say "white black" 10 times as fast as you can.
Sue's snapshot shop.

DRAW-A-WORD

This word is the name of a wild animal: Draw something a man wears around his neck. Add a growl. What is the animal?

(tiger)

FUN ON A BLACKBOARD

Make round-robin funny faces on the blackboard in your classroom (at recess, of course!). One boy or girl draws the outline of a face. The next adds an ear. The next adds an eye. The next adds the hair. The others, in turn, add the other ear, the nose, the mouth, etc. The results will be very funny.

YOUR OWN FARM

Equip It With Paper Cows, Sheep, Hogs And Horses

How would you like to settle down and become the owner of your own farm, or the owner of a stable of fine horses?

Sounds like fun, doesn't it?

Of course, when I say "farm" or "stable of horses," I mean a farm or a stable that is made of paper and cardboard and wood—not a real farm like Dad's or Uncle Charlie's. But it's fun anyhow.

Let's suppose you decide to start the farm. You will want a herd of cows and some sheep and a few horses and some hogs. You can acquire these by looking through newspapers, magazines and catalogs for pictures of those animals. Clip them out and glue them to heavy cardboard. Then cut the cardboard away from around each animal.

You must now get some little strips of wood about an inch wide and half an inch thick. Cut the wood into sections of various lengths. Select a piece that is long enough to serve as a base for a cow, for instance. With a saw or knife, carefully cut a slot in the wood from one end to the other. To make the cow stand up, simply slide her hoofs into the slot. You can then stand her any place you wish in your imaginary barnyard or pasture.

A stable of fine horses can be made in the same manner. You can have nothing but race horses in your stable, if you wish, and you can have a few hunting dogs around, too, if you watch out for pictures that are of the right size.

Try it! It's fun!



STICKERS FOR YOUR BOOKS

They Identify You As The Owner

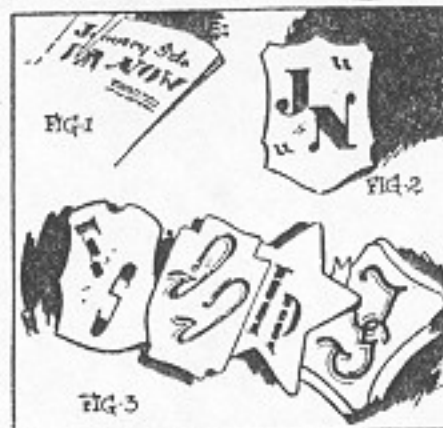
If you like books, you will find it fun to make some unusual little identification stickers to paste on their flyleaves.

Each sticker will bear your initials and thus will serve as a mark of ownership which will help prevent your books from getting lost. The initials are just big letters of different shapes which you cut out of advertisements in newspapers and magazines. If possible, you should use letters of the same design on each separate sticker, but it is not absolutely necessary.

First, go through your old newspapers and magazines and find attractive letters to use for the initials. Then, out of white paper, cut a shape for the stickers. You can use a shield shape, if you wish, or a star shape. Various shapes you may like are indicated in Figure 3. Having decided on the shape, cut out a dozen copies of it to make a dozen stickers.

Paint each shape with your water colors. While the paint is drying, carefully cut the white paper away from around the initial letters you have chosen. Then, with glue, fasten these initials to the colored stickers, placing them attractively, as in Figures 2 and 3.

When the glue has dried, all you have to do is put paste on the back of the stickers and place one in each of your books.



MAGNETIZING A STICK

You Wave A Card And The Stick Moves
In A Mysterious Manner

To perform this stunt you need a lightweight stick, preferably a round one. A walking stick will be perfect. You also need a piece of smooth cardboard.

Balance the stick on the back of a chair as the boy in the picture has done.

Then hand the cardboard to your "victim" and say, "Can you make the stick move on the back of the chair without touching it with this card or anything else, or without fanning it or blowing upon it?" Unless he knows the secret, he can't do it.

When he gives up, take the cardboard in your own hands. Rub it briskly on your coat for a few minutes. Then quickly hold it near one end of the balanced stick. In less than a second, slowly begin to move the card to one side of the stick. You will be surprised to find the stick following the card!

This is caused by magnetic power set up in the cardboard when you rub it on your coat. The same effect can be obtained with a comb and a small piece of tissue paper. Rub the comb on your coat and then hold it an inch above the tissue. The paper will rise to meet the comb.



GREETING CARDS

You Punch Out A Picture With A Pin

At Christmas time it's fun to make your own original Christmas cards. There are lots of ways to do it, but one of the most interesting is the punch-out process. All you need is a pin.

When the greeting-card is finished, the picture on it, instead of being drawn or painted, is outlined with small pin-holes. When it is held up to a light, the light shines through these little holes in a very attractive manner. The figure or design outlined by pin-holes can be colored with paints or crayons and made doubly attractive.

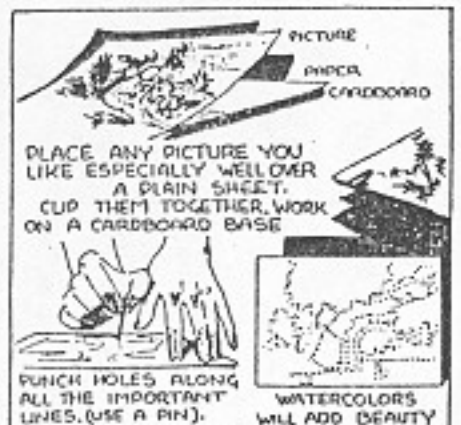
To begin, select out of a magazine or newspaper some picture or design that appeals to you. It can be a picture of a flower, of Santa Claus, of a boy or girl or any other figure or scene that can be reproduced understandably in outline only.

Place this picture over a plain sheet of heavy paper and clip the two together so they will not slip.

Lay the two sheets on a piece of cardboard or a pillow-top to provide a soft base.

Now, with a pin, punch small holes around the outline of the figure. Make the holes fairly close together.

When the entire outline has been punched, lift the original picture and you will find the outline has been made with holes in the plain paper. Color it if you wish, and then with crayons or paint print "Merry Christmas" across the bottom and add, "From John," or "From Mary." It can be put into an envelope and mailed. Anybody would be happy to receive such a card from you.



MEMORY CLOCKS

They Remind You When To Do Various Things

Memory clocks are very businesslike to hang up in your room at home.

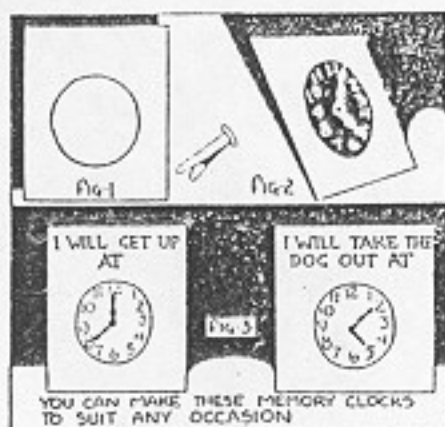
The purpose of a memory clock is to remind you (or others) when you are going to do certain things. One clock will state, "I will get up at—" and the hands of the clock reveal the hour. Another can say, "I will take the dog out at—" and then give the hour. A third can say, "I will go out to play at—" A fourth can say, "I will do my homework at—" The hours indicated by the movable hands of each clock can be changed any time you wish.

To make a memory clock you need a piece of cardboard five inches wide and seven inches long. Draw a heavy circle on it four inches in diameter (Figure 1). On this circle letter the twelve hours as on the face of a real clock. Make a small hole in the center of the clock.

Out of cardboard cut an hour hand and a bigger minute hand. Color them black with crayon. Make a small hole in the hub end of each. Fasten them to the face of the clock by inserting a brad-type paper clip (see Figure 2) through the holes in the hands and in the center of the clock. You will find that the two hands can now be moved to indicate any hour and will remain there until moved again.

Above the face of the clock, letter the words that designate the purpose of the clock.

It is now finished and ready to hang on the wall of your room.



HOOP-BOWLING

A Good Game On A Lawn

A good game to play on the lawn is Hoop-Bowling. The necessary outfit is easily made by any boy or girl.

A hoop is stood upright on the ground. Each player has an indoor baseball. Players stand at a line 25 or 30 feet in front of the hoop. The object is for each player to see if he can roll his indoor baseball across the lawn so accurately at the hoop that the ball will pass through it. Each time he succeeds in doing this he gets five points. Each time he fails, he is penalized three points. The first player to get 50 points wins the game, and a new game can be started.

The player who wins 25 games becomes the champion. Further games can then be played to see if someone can win the champ's crown away from him.

The hoop—a common hoop off an old barrel—is shown in Figure 1. Figure 2 shows how to fasten a six-inch stake to the outside of this hoop with a couple of sturdy nails. To stand the hoop upright, simply pound the stake into the ground.

It is a good idea to erect the hoop three or four feet in front of a wall or a fence. This will act as a backstop for the balls and you will not have to chase after them so far.



DANCING PENCILS

A Rubber Band Unites Them

Make a pair of dancing pencils. You need two pencils of equal length—long pencils are better than stubs, although stubs can be used, too. The pencils are shown in Figure 1.

Stand the two pencils together and slip a stout rubber band over them, looping it twice (Figure 2).

Twist the rubber band by winding the pencils in opposite directions, as in Figure 3.

When you have the rubber wound up very tightly, place the pencils on the table top or the floor and let go of them. The result will be as in Figure 4. If the pencils stop before the rubber band is completely unwound, prod them or turn them over and they will finish their dance.

Some of my young friends who have made this amusing toy call it "Wrestling Pencils." They use two pencils of different colors and make a game of it by guessing which pencil will be on top when the two of them stop twisting, turning and flying around.



HOW TO PLAY ROCK GOLF

Two Holes And Some Rocks Are The Equipment

Rock golf is a fine game for boys and girls to play and, because it is so easy to fix up the necessary equipment, it is an ideal spur-of-the-moment pastime.

All you need are two holes in the ground (or in the sand, if you play the game at a beach) and some rocks which are light enough for you to toss a distance of 20 feet.

Each player should have three rocks. These can be flat, round or any other shape that suits the player's fancy.

After the players have selected their rocks, each rock should be identified in some manner. Perhaps the easiest way to do this is for each player to scratch his initial on his rocks, using a nail, as shown in Figure 2.

Next, the two holes must be dug (Figure 1). These should be at least 20 feet apart and should be no less than 6 inches deep and not more than 10 inches in diameter. If they are any bigger in diameter it will be too easy to toss the rocks into them.

When the holes have been dug, you are ready to play the game. One player at a time stands beside one of the holes and, taking careful aim, tosses one of his rocks at the other hole (Figure 3), his object being to cause his rock to fall into the hole.

He throws all three of his rocks, one at a time, and then it is the next player's turn.

Each rock that lands in the hole gives its owner three points. Each rock that does not land in the hole penalizes him two points. The player who gets 25 points first is the winner.

When the players have thrown all their rocks at one hole, they go to that hole, remove the rocks and then toss them back at the other hole, continuing in this manner until someone has won the game.



PATCHWORK PICTURES

You Make Them Out Of Colorful Scraps Of Cloth

Patchwork pictures are an ideal indoor pastime.

They are made out of scraps of cloth cut up in proper shapes and then glued to cardboard or heavy paper. You can make figures of boys and girls and very attractive landscapes.

Figure 2 in the adjoining sketch shows what patchwork pictures look like when finished. The Dutch boy is dressed in pants cut out of a piece of a discarded old blue-and-white polka-dot necktie. The ground was cut out of a scrap of herring-bone suit cloth. The boy's shirt was cut out of a scrap of an old checked shirt. The boy's face was cut out of a piece of pink cloth and the eyes and nose were drawn on it with a sharp-pointed pencil. His cap was cut out of a scrap of black cloth. The windmill was made of several colors of scraps and the sky was made of white cloth, with light blue patches glued on for clouds. The wooden shoes were made of yellow scraps.

The picture of the girl in Figure 2 was made out of scraps of black cloth, the sleeves and hem-trimming out of scraps of lace.

It's all quite easy to do. Best way to proceed is to draw on paper the picture you wish to make. Look then in Mother's scrap-basket for pieces of cloth that will be appropriate for parts of the picture. Divide the drawing into sections—the face in one section, feet in another, trousers in another, etc.

Pin each section to the kind of cloth you wish to cut for that section. Then, with scissors, cut through both pattern and cloth.

When all the parts have been cut out neatly, proceed to glue them to the cardboard mounting, assembling each patch in its proper place.

If there is to be a background of clouds and ground, these should be glued upon the cardboard first and then the patches that will make the figure should be glued over the background.

After one or two attempts, you will see for yourself exactly how patchwork pictures are made and then you will have no trouble making lots of them.



EASY TRANSFER FUNNIES

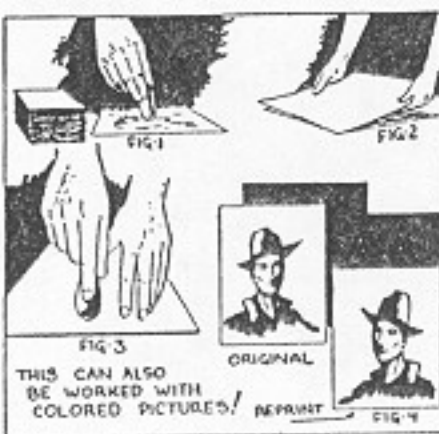
Make Exact Reproductions Of Newspaper Pictures

Home-made transfer pictures are easy to make, and here is a simple process any boy or girl can follow. This is a project that is good for many afternoons and evenings of fun.

Obtain a candle. A fat, white one will serve best. Next, select out of the newspaper some picture that you would like to transfer to another sheet of smooth, white paper.

It can be a figure out of a comic strip, out of an advertisement, or it can be a reproduction of a photograph. The more recently the paper has been printed, the better your transfer picture will be.

The third step is to obtain a piece of smooth white paper. To prepare it, rub the candle over one entire side as shown in Fig-



ure 1.

Next, place the tallow side of the paper upon the picture you wish to transfer, as in Figure 2.

Hold an old spoon in your hand as in Figure 3 and vigorously rub the top side of the tallowed paper with the back of the spoon's bowl.

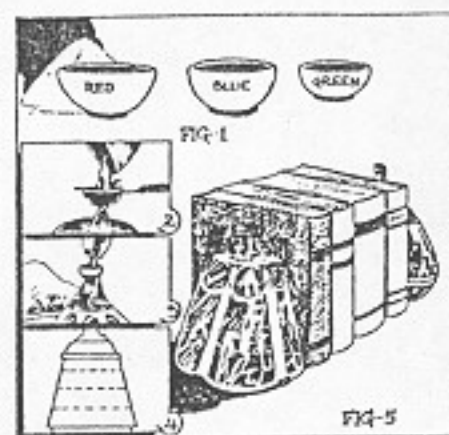
When you have done this and are sure the spoon has not missed any corners, carefully lift the paper up. You will find that the newspaper picture now appears on the tallowed surface of the second paper. The difference will be that the transfer picture (or reprint) will appear reversed, as in Figure 4. If lettering is in the picture, it also will be backward.

If you wish, you can transfer the reprint to still another piece of paper. This will cause the printing to run forward instead of backward. Simply lay the transfer picture on plain white paper and run the spoon over its back. Lift the top paper and the second reprint will appear on the new sheet.

SAND BOTTLES

They Are Decorative And Useful

Sand bottles are not only fun to make, but can be used as decorative pieces to place on a table, desk or over the fireplace and, as suggested by Figure 5 in the illustration, two such bottles can be used as book-ends. Each bottle contains several layers of brightly colored sand. Some of the sand is red, some is blue, some is orange, green, etc. You color the sand yourself with dyes.



Any bottle will be satisfactory, but the more fancy its shape the more attractive the finished effect will be.

You must use white sand. Yellow or brown sand, ordinarily used by bricklayers, is not the correct type. White sand can be obtained in pet shops, where it is supplied for aquariums and for birds.

The dye used to color the sand is the same kind Mother uses to color articles of clothing. Ask her to help you prepare the dye and try to have at least three or four colors. Mix each color in a different pan. When the dye is ready, pour some of the white sand into it and allow it to remain long enough to become colored. Then, as in Figure 2, use a strainer to separate the sand from the dye water. Place the wet sand into a drying bowl (a separate bowl for each color as in Figure 1) and let it stand until all the moisture has evaporated.

When the sand has dried, it is ready to pour into the bottle, one color at a time. This must be done carefully, so each color is spread in a separate layer, as indicated by the dotted lines in Figure 4. To spread the layers evenly in the bottle, poke a stick into the neck and use it gently as a rake.

When the job is finished you will have a very pretty bottle containing a layer of one color at the bottom, another color on top of it and so on up to the very top of the bottle.

JAW-BREAKERS

Flying fighters flew from Florida to France.

Where were you when we ran right west?

Wee Willie Winkle writes wild, woolly Western whoppers.

A tiny, thin-trimmed tree.

The big black bear bumped the baby billy goat.

Higgledy haggledy huggledy hoggledy.

Penny Packer picked a pink flower.

Polly Platt pulled poor Pauline's pigtales.

Shall Sally Shooker seek Sharon's sister's six shiny shoes?

Betty Botter beat the bitter batter to make the batter butter better.

BULL'S-EYE BOX

You Make The B-B's Hit The Targets

A pocket game for a handy boy or girl-to make is called Bull's-Eye.

It is one of those games in which you roll little balls around in a box with a transparent cover, trying to get them all to fall into holes and stay there.

To make a Bull's-Eye Box, you need only a small round pill container such as druggists use or face powder comes in (Figure 1), a piece of cardboard, a piece of cellophane, a strip of adhesive tape and four B-B's.

Remove the lid from the pill box. Cut a circular piece of cardboard that will fit quite snugly into its bottom.

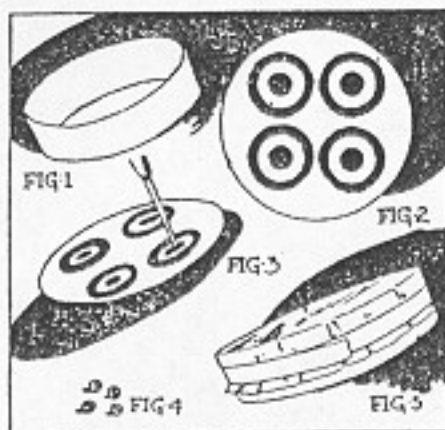
With pencil or ink draw four targets on this cardboard, as shown in Figure 2.

Using a paper punch, or, if you have none, a sharp-pointed instrument, make a hole in the center of each target (Figure 3). The holes are the bull's-eyes. Each one should be just large enough for a B-B to rest in. Smooth the edges around the holes.

Place this prepared cardboard in the box, pressing it down so it is tight against the bottom. Put the four B-B's (Figure 4) into the box. Then cover it with the piece of cellophane.

When you have the cellophane spread as smoothly as possible, strap it tightly in place with the strip of adhesive tape (Figure 5). Your Bull's-Eye game is now ready for use.

See how long it will take you to shake the box and cause all four B-B's to become lodged in the bull's-eyes.



SCREEN-SPRAY PICTURES

Hang Them Up In Your Room Or Give Them As Gifts

I'd like you to try this unusual way to make spatterwork pictures.

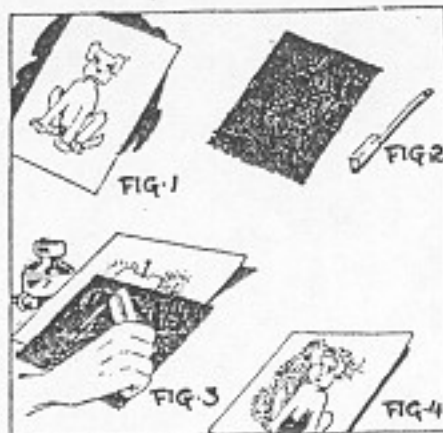
Get a piece of window screen and an old toothbrush (Figure 2) and some ink, or, if you prefer different colors, some dye that you can easily make by soaking a piece of colored crepe paper in a dish of water.

Find a picture or a design that you would like to reproduce in silhouette on a plain piece of paper. Figure 1 suggests a picture of a dog.

Cut the picture out as you would a paper doll, and use a pin or thumbtack to fasten it upon the plain paper. Now, dip the old toothbrush into the dye or ink. Hold the piece of screen about two inches above the paper and rub the brush across it (Figure 3). This will send a fine spray of ink or dye through the little openings in the screen and down upon the design pinned to the paper, as well as onto the paper around the design.

When the whole thing has been sprayed, lift the pattern off the paper and the result will be as in Figure 4—a silhouette reproduction of the original picture, surrounded by many fine dots.

For added effect, you can spray several different colors—one at a time—to make one picture. If you try this, be sure to clean one color off the screen and the toothbrush before applying another.



TEST OF HAND CONTROL

Look Into A Mirror And Draw A Square

How perfectly can you control your hand with your eye?

Here's a way to find out.

Try to draw a perfect square on a piece of paper without looking at the paper except as you see it in a mirror.

You will discover that it is almost impossible to draw a perfect square. One side or the other will always be cockeyed.

To learn how to arrange the mirror and the paper for this test of skill, look at our illustration.

You will note that the mirror must be propped up or held up before you on a slight slant.

Place the piece of paper before the mirror so that it is reflected in the glass.

Holding your left hand in such a way that you cannot possibly see the paper except as it appears in the looking glass, take your pencil in your right hand and proceed to draw a perfect square—if you can. Watch your pencil in the mirror and guide your hand accordingly.

perfectly you can write your name, using the same method. Have your friends try the experiment.



MATCHBOX THEATER

The Puppet Actors Are Made Of Yarn

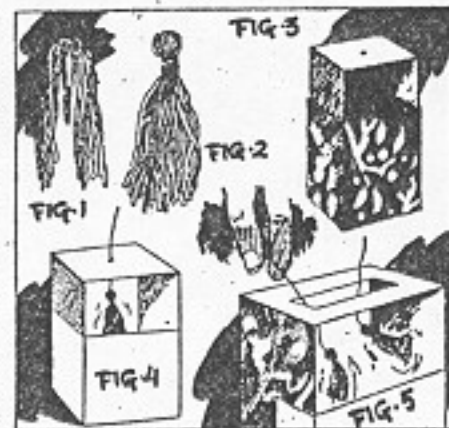
Out of an empty matchbox you can make a nifty little theater in which yarn puppets are the dancers and actors. The puppets are easily made of wool and are dangled on the stage by means of a black thread running through the end of the box.

The prepared matchbox, with a yarn actor in it, appears in Figure 4. The stage opening is made by sliding the inside of the box out about halfway. Punch a small hole in the projecting end, through which the puppet control-thread will slide easily up and down. To decorate the box, which stands on one end, paste pieces of wallpaper around it as in Figure 3. Paint the inside of the box black with ink. This will make the black control-thread less visible to the audience.

Figures 1 and 2 show how to make the puppets. As in Figure 1, drape some pieces of colored yarn over an ordinary screw and then, as in Figure 2, tie the yarn to the screw with thread so that a small ball, intended to be the puppet's head, is made. The screw gives the puppet enough weight so it can be readily dangled on the end of the control-thread, as shown in Figure 4. Tie the control-thread to the neck of the puppet.

Have your audience sit in front of the box and, while they watch, make the puppet dance up and down in the stage opening by jerking the thread. For a spotlight you can have someone hold a small flashlight aimed at the stage opening.

If you would like to use the two puppets at once, thus adding to the animation in the theater, cut a long, wide opening in the end of the matchbox as in Figure 5.

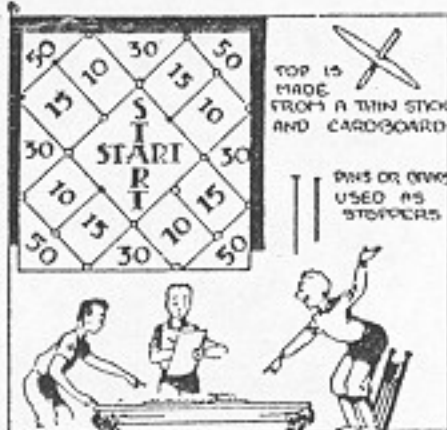


PEG TOP GAME

Spin The Top For The Highest Score

When Dad or Mother is in a mood to be enticed into a little fun, get him (or her) to oppose you in an exciting game of Peg Top.

Peg Top is a home-made game. To make the outfit for yourself, obtain a piece of very heavy cardboard or wood about 14 inches square. With pencil and ruler mark it off into sections as shown in the drawing.



ing. Around a square in the middle make eight other squares or oblongs and eight triangles. Print big numbers in these sections.

At each point where a line crosses another line or meets another line on the board, push in a pin or a brad. The location of these pins is indicated by little circles in our drawing.

Next, make a top by pushing a thin, round stick through the exact center of a perfect cardboard disc about 1½ inches in diameter. The game is now ready.

Players take ten turns spinning the top. The top must be started in the square marked "Start." It must be allowed to spin until it comes to a halt on one of the numbered areas. Whatever the number of that area is, is the player's score for that turn. Keep track of the scores and the player with the biggest total after ten turns wins.

The pins in the game board will cause interference for the whirling top and bounce it from square to square before it stops spinning and falls.

If the top spins off the board or doesn't spin out of the square marked "Start," the player gets another turn.

FUN WITH OLD RULERS

Imitate A Machine Gun And An Airplane Motor

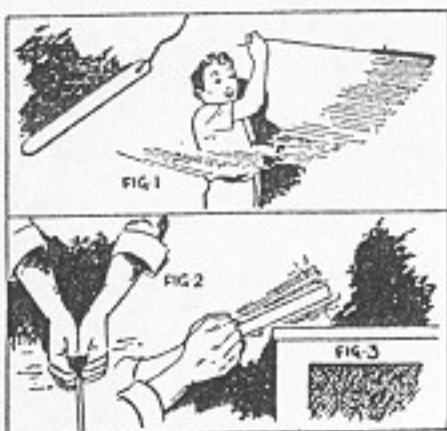
Here is how to have fun with a ruler.

Actually, any smooth, thin stick of hard wood will do, but if you have an old ruler on hand it will save whitening.

There are two good fun-projects to try. One is illustrated at the top of our drawing. It's called Airplane Motor.

Bore a hole through one end of the ruler. Pass a stout string through this hole and tie it. The string should be about five feet long. Grasp the free end of the string in your hand and whirl the ruler around and around over your head as the boy in the picture is doing. The loud hum the ruler will soon begin to emit will resemble the sound of an airplane motor.

The second stunt is the Machine-Gun Ruler. Hold the ruler between your fists as shown in Figure 2. Rest the edge of the ruler against a hard surface (something that cannot be marred, and that excludes the dining-room table or Dad's desk). Press your fists together with great force, as indicated by the little arrows in Figure 2. As you do so, allow your forearms to shake. This will cause the ruler to move rapidly against the hard surface and the tat-tat-tat of machine-gun fire will result.



HOW TO MAKE A DISH

You Mold Strips Of Paper Over A Bowl

Make a paper bowl.

Start with a real bowl for a mold. It should be shaped something like the one in Figure 1, so that the paper dish, after being molded, can be slid off easily.

Cut a large number of strips of paper—newspaper will do—making some of them half an inch wide and others one inch wide.

Wet some of these strips

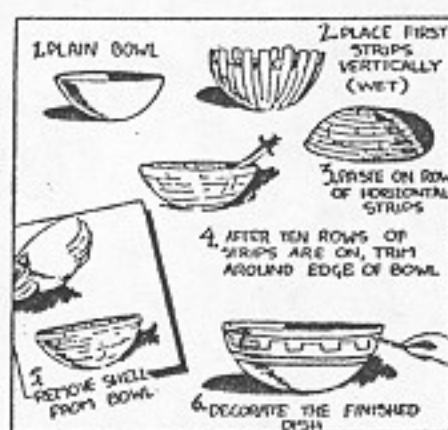
in water and stick them vertically over the entire outside surface of the bowl as in Figure 2. Allow them to overlap and allow their ends to extend an inch or so above the rim of the bowl. Fold these ends over and inside the bowl.

Next, dip some more strips in a flour-and-water paste and put these all over the first strips, horizontally (Figure 3).

Put on eight more rows of paste strips, alternately horizontal and vertical.

When all have dried, use a knife to trim the extending ends of the strips off at the top edge of the bowl (Figure 4) and then simply lift the paper form off the original dish (Figure 5). Sandpaper it and paint it with white house paint. Later put on a design.

Do not put liquids or foods in this bowl. Use it as a decoration only.



THE AMAZING RACE HORSE

Whirl The Card And A Jockey Appears

Make the jockey and his amazing race horse.

On one side of an oblong of cardboard is a picture of a race horse without a rider. On the other side is a jockey without a horse.

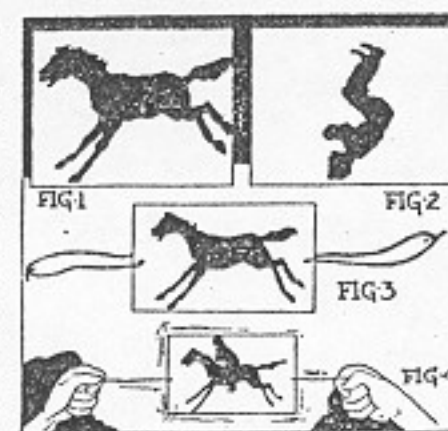
Strings are tied to the card at each end and these are twisted up until they are tight. Then, when the strings are allowed to untwist, causing the card to revolve rapidly, the jockey will appear to be astride the horse's back.

This is an illusion that can be carried in your pocket, to be taken out and shown whenever you wish to do so.

The cardboard on which the horse and jockey are drawn can be of any size you wish, but it will be most convenient if it is about 2¼ inches long and 1¼ inches high. It should be of heavy cardboard, so that the strings attached to it will not easily pull through its sides.

With pencil, ink, crayons or paints, draw on one side the silhouette of the horse in a running position, as in Figure 1. On the other side, draw a silhouette of the jockey, upside down, as shown in Figure 2.

Attach a loop of string to each end of the card (Figure 3). Whirl the card around until the strings are tightly twisted. Finally, to cause the card to whirl in the opposite direction, pull outward on the strings as in Figure 4 and the illusion of the jockey on the horse's back will be created.



A PAPER SERPENT

It Will Scare Your Friends

If you want to have a lot of fun frightening unsuspecting friends, make a Chinese Serpent.

When put together, a Chinese serpent is a stringful of crepe paper discs threaded to a long stick. When you move the stick, as the boy is doing in Figure 4 of our drawing, the "serpent" will wiggle around in the air in a startling manner.

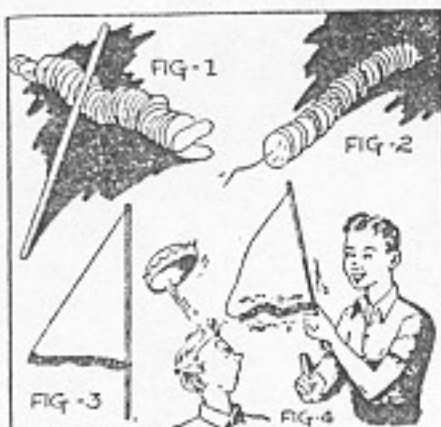
The stick should be about 18 inches long. A notch should be cut around it near one end and another notch should be cut five inches from the other end.

Out of crepe paper of various colors cut many, many little discs, squares and star-shaped pieces. These should be of the same size—about one inch in diameter. Figure 1 shows some of these discs and also the notched stick.

String the pieces of crepe paper snugly together on a heavy black thread, as shown in Figure 2. Also thread a small weight, such as a washer, onto the thread and tie it so that it will remain snugly against the last disc of paper.

Tie the short end of the thread to the notch five inches from one end of the stick. Tie the long end of the thread to the notch close to the end of the stick. The whole thing should now appear as in Figure 3.

Hold the stick upright, but tipped slightly forward. The washer weight on the thread will cause the paper serpent to project forward. By moving the stick slightly, the serpent will weave and twine about in an amusing manner.



BALLOON TENNIS

You Blow The Balloon Across A String

Balloon tennis, played on a table, is a great game for boys and girls because there's lots of action in it.

Two can play it or it can be played at a party with four or five on a side.

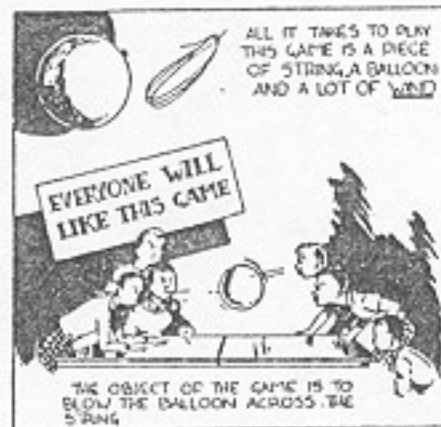
All you need is a toy balloon (better have several in case of breakage), a piece of string and a big table.

The game is played along the lines of ping-pong, but instead of using paddles the players blow the balloon from one side of the table court to the other, trying to cause the balloon to fall to the floor on the opposing team's side of the court.

The table is made into a court simply by tying the string across the center of it as the dividing line.

One side serves the balloon to the other. The server rests the balloon on his palm and, taking a deep breath to get plenty of power, blows upon it, trying to send it across the string and out of reach of the opponents so it will fall to the floor. If his blow is not strong enough to do this, his teammates must be ready to help out. The players on the other team try to blow the balloon back across the string and onto the floor without touching it with their hands.

Each time either team succeeds in blowing the balloon to the other team's floor, it gets one point. The team first scoring five points wins.



LOOSE-JOINTED DANCER

He Jigs When You Jerk A Thread

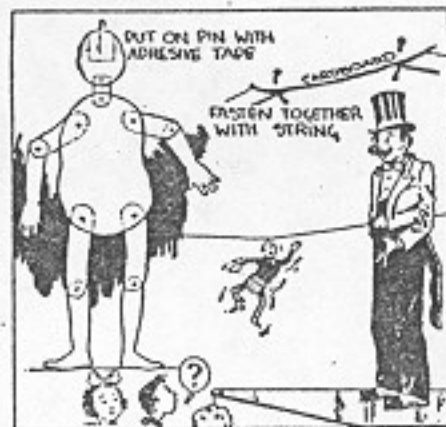
Here is a jumping jack made of cardboard. He is loose-jointed and hangs on an invisible black thread. When the thread is jerked the jumping jack will dance.

Out of heavy cardboard cut the body, head, arms and legs as shown at the left of our drawing. Fasten these parts together with knotted string in the manner shown in the upper right-hand corner of the drawing. Knot a string and pass it through a hole in the shoulder of the body. Then pass it through a hole in one of the upper arms. Draw the knot tightly against the body, then make another big knot close to the hole in the arm. Thus, body and arm are fastened together.

At the top of the jumping jack's head affix a hook made by bending a pin with pliers. The hook is held to the head by a small piece of adhesive tape.

Color the front of the jumping jack with paints or crayons, giving it a face and clothing.

Next, tie a long black thread to the back of a chair. Hang the jumping jack by its hook on this thread. With the loose end of the thread in your hand you can stand away from the chair and make the jumping jack dance merely by jerking the thread slightly.



DECORATE A JAR

Turn A Jelly Glass Or Pickle Bottle Into A Gift For Mother

Here is how to make a decorated jar for Mother's table out of a plain jelly glass or a pickle bottle. The finished jar, covered with a coating of dried paper pulp, is gaily decorated with pictures in crayon or water color (Figure 5).

Obtain the jelly glass or pickle bottle and several sheets of old newspaper (Figure 1). Tear the newspaper into many, many tiny pieces, about as big as snowflakes (Figure 2) and crumple them between your hands so they become thoroughly limp. Put these very small scraps into a big bowl or pan and pour in some water—just enough to make them all wet. With your hands, knead the wet paper as you would bread dough.

When the paper has been worked into a pulp and is still damp, pour in some flour (Figure 3) and continue to knead with your hands until the paper and flour have become thoroughly mixed and pasty. It is now ready to apply to the outside of the jelly glass or pickle bottle. Do this by patting it on with your hands, making it as smooth as possible (Figure 4). The pulp will stick to the glass because of the flour paste you have mixed into it.

Let the paper coating dry. When it has become quite hard, use your crayons or paints to draw or paint a picture on it as in Figure 5. It will make a nice gift.



BECOME A JUGGLER

Practice With One Ball, Then Try More

Any boy or girl who can juggle two, three or four balls is always able to entertain his friends, so here is a lesson in how to juggle.

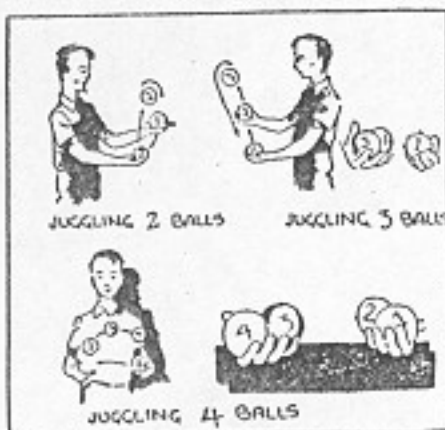
Start with one ball. Toss it about a foot into the air and catch it with the same hand. That's easy to do, but practice it nevertheless with the left hand as well as the right.

Next, try two balls. Our sketch shows how to proceed. Put one ball (No. 1) in the left hand and the other (No. 2) in the right hand. Toss the No. 2 ball into the air with the right hand. At the same time toss the No. 1 ball from the left hand to the right. Next, catch the No. 2 ball in the left hand and repeat. That isn't so hard to do, either.

Three balls are a little more complicated. Put one ball (No. 1) in your left hand. Hold two balls (Nos. 2 and 3) in your right hand.

Toss Ball No. 3 about two feet into the air. When it has reached the peak of the toss and is about to descend, toss up the No. 2 ball. At the same time, toss the No. 1 ball from your left to your right hand and catch the No. 3 ball in your left hand (see the sketch). The problem is to keep two balls in the air at once.

In juggling four balls, three of them must always be in the air at the same time. Hold Balls 1 and 2 in the left hand and Balls 3 and 4 in the right. Toss Ball 4 up first (about three feet), immediately followed by Ball 3. As Ball 3 leaves your right hand, toss Ball 2 from the left to the right hand, followed by Ball 1. As your right hand tosses Ball 2 after Ball 3, catch Ball 4 in the left hand and pass it to the right hand.



TRICKY TUMBLERS

Turn Them Upside Down In Three Moves

Next time you want to show someone how much more you know than he does, challenge him with the Puzzling Glasses stunt. It's a dandy.

You must have three glasses. Arrange them as indicated in the upper left corner of the illustration. The No. 1 glass stands on its bottom, the No. 2 glass is upside down and the No. 3 glass is right side up.

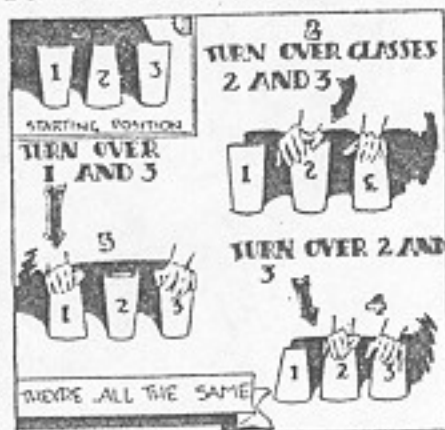
The big problem is this: In three moves, moving two glasses at a time, can you rearrange the glasses so that all of them are upside down?

It can be done. Figure 2 shows the first move. You simply turn Glass No. 2 so it is right side up and Glass No. 3 so it is upside down.

Next move (Figure 3) requires you to turn Glass No. 1 upside down and Glass No. 3 right side up.

Third and final move (Figure 4) requires you to turn Glass No. 2 and Glass No. 3 upside down. The three glasses are now all standing on their rims.

Memorize the three moves. Then try the stunt on Dad.



CARDBOARD COMPASSES

You Can Draw A Perfect Circle

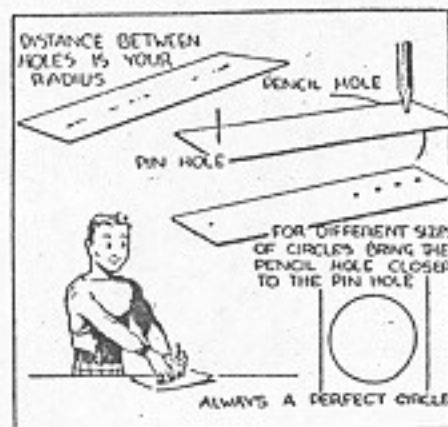
Lots of times a boy or girl who is making something finds it necessary to draw a perfect circle. It's a pretty hard thing to do without a pair of compasses and not always are compasses at hand.

What to do?

Well, in two shakes of a lamb's tail you can make a pair of compasses out of a piece of cardboard.

Use a fairly stiff strip of cardboard. Push a pin through it near one end. From this pin-hole, measure off with your ruler the radius of the circle you want to draw. At that point make a small hole in the cardboard, just big enough to receive the point of your pencil.

With the pencil in this hole, place the cardboard compasses on the paper where you wish to draw the circle. Hold the cardboard to the surface of the paper with the pin. Then merely swing the cardboard around the pin by pushing the pencil. A perfect circle will result.



HOOP STUNTS

Make A Hoop Roll Straight Away And Back To You

Become the expert hoop-roller of your neighborhood! Any boy or girl can do so with just a little practice.

Everybody knows how easy it is to roll a hoop simply by starting it forward and then running beside it, hitting it with a stick to keep it moving. That in itself is great fun, but an expert hoop-roller is a boy or girl who has learned how to make a hoop perform tricks. You can, for instance, make your hoop roll forward and then come right back to you so you can catch it in your hand.

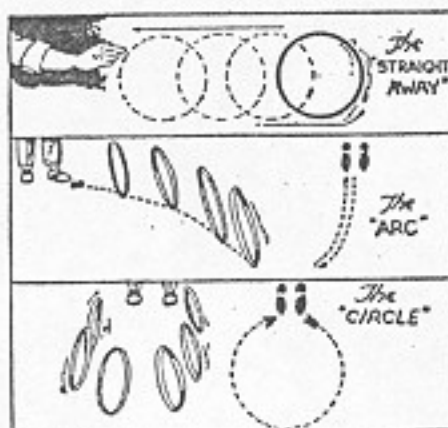
Any hoop will do. Even a hoop off a barrel will be satisfactory.

To perform the Straightaway, in which the hoop rolls forward and then returns, look at the top of our illustration. The secret is this: As you toss the hoop forward along the floor with your hand, you give a slightly upward jerk of your wrist. This will cause the hoop to revolve toward you (see dotted lines) despite the fact that the force with which you throw it causes the hoop to slide forward. It continues sliding forward on the floor until its momentum gives out, whereupon its revolutions toward you will catch friction on the floor and send the hoop straight back to you. Try it two or three times and you'll see how easy it is to do.

The Arc stunt is performed in the same way, except that, in tossing the hoop forward with an upward movement of your wrist, you also give your wrist a slight flip to one side, at the same time tipping the hoop gently to that side (see dotted lines).

To perform the Circle, do not use the backward revolution. Simply roll the hoop forward, but slightly to the right or left, and tip it gently toward the inside of the circle. Practice sending it in small circles at first.

Try them all! They're fun!



A TEST FOR YOUR LUNGS

An Amazing Feat To Perform

Here's an amazing feat to perform. A pin is stuck through the center of a piece of cardboard about two inches square.

The pin is placed into the hole of a thread spool, with the card resting against the end of the spool.

Placing the other end of the spool to your mouth, blow through the hole, trying to blow the paper off. The cardboard won't budge.

That sounds impossible, of course, but all you have to do to assure yourself it really works that way is try it.

The thread spool can be any one that Mother will let you use. The pin which you stick through the cardboard is an ordinary one.

Rest the cardboard on the spool end as shown in the sketch. Hold the other end of the spool to your lips. At the same time steady the cardboard against the end of the spool with your hand until you begin to blow into the spool hole. As you start blowing, let go of the cardboard. It won't fall. It simply won't come off the spool no matter how hard you blow.

If the stunt doesn't work the first time you try, the trouble most likely will be that you are blowing outside the spool as well as into the hole. Purse your lips tightly so you are sure to blow only into the hole.

The card can't be blown off because, in blowing into the hole, you create a semi-vacuum which holds the card in place despite the power of your lungs.



TIN-CAN GOLF

You Set The Course Up In The Living Room

Tin-Can Golf is fun to play indoors. If Mother will let you move the furniture back, set the equipment up on the living-room carpet.

Our diagram shows how to lay out the five-hole course. Each hole is an ordinary tin can. Use a golf ball or a small rubber ball and strike it with a regular putter or a piece of broomstick.

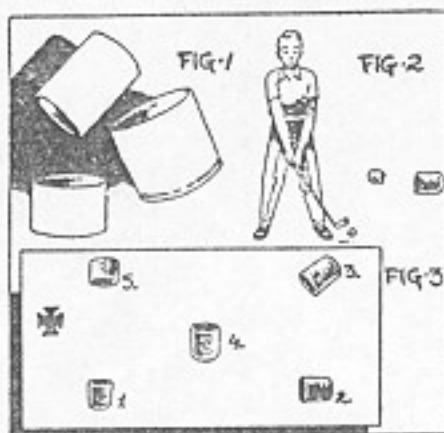


Figure 1 shows the various shapes of suitable tin cans. Those of ordinary size are best. Place them on their sides (Figure 2) at the proper locations on the floor. The idea then is to putt the ball into the cans in rotation. As in real golf, count the strokes used from hole to hole in order to know your score after the fifth and last hole. The player who travels around the course in the least number of strokes is the winner. After a ball has been hit into a can, the player removes it, places it in front of the can and shoots for the real hole.

Figure 3 shows how to arrange the five cans. The numerals indicate the order in which each player travels over the course. The starting place is indicated by the large black cross. The openings of the cans should be placed so it is neither too hard nor too easy to make a hole-in-one. To keep the cans from rolling, small blocks of wood can be fastened to their sides with tacks or with rubber bands placed around the cans.

MAGNETIZED ACROBAT

He Will Perform Many Funny Tricks

Here's a fine little fun-project to make for yourself or for a good friend—maybe one who is ill.

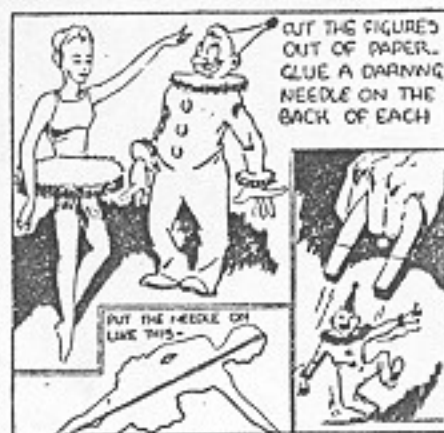
It's the Magnetized Acrobat.

Get a long darning needle. Guided by the length of the needle, draw the figure of a boy or girl acrobat or dancer (or cowboy or clown) on a heavy piece of paper. The figure should be no taller than the length of the needle.

Color the figure with crayons or paints and then cut it out.

Glue the needle to the back of the figure. To do this, just make a stripe of glue down the back and place the needle in it. One end of the needle should be even with the top of the figure. The other should be even with its feet.

To make the figure stand up, simply hold an ordinary magnet above its head. By experimenting, you can learn to make the figure stand erect, seemingly without support. It will swing by its head or feet from your magnet and, when placed flat on a table, can be made to move around in a very funny manner.



ENVELOPE PEOPLE

Build A Little Town

An envelope town is great fun to build. You can make the houses, stores and other buildings out of cardboard boxes and the people to populate the town are cut out of envelopes. They will stand up and can be moved about as you wish.

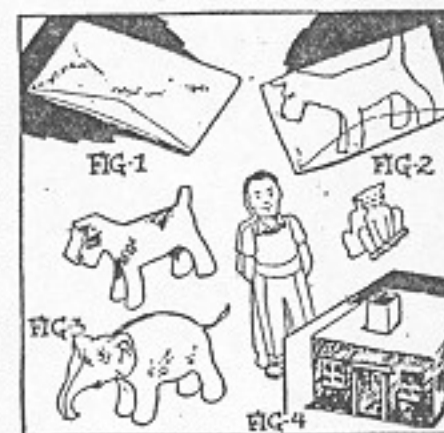
Figure 4 shows how to make a house out of a box—a cake box will do. The windows, door and shrubbery are drawn on the side of the box with crayons. The chimney is a small matchbox standing on end.

Figures 1, 2 and 3 show how to make the envelope people. Use an ordinary envelope (Figure 1). For tall people, use the envelope lengthwise. For short people and small animals such as dogs, use the envelope the short way.

First, seal the flap of the envelope. Then with pencil draw on one side of it the outline of the figure you wish to make as in Figure 2, which shows the outline of a dog. The top of the figure must always touch the fold of the envelope, because the figures, when cut out, must be two-sided—connected at the top and disconnected at the bottom. This allows the legs to be spread apart while the two sides are joined at the top (see the example in Figure 3).

When the outline has been drawn, use your scissors to cut the figure out. Cut the envelope apart at the feet. You will then see that the figure will stand when the two sides are spread slightly apart.

When the figure has been cut out of the envelope, color it with crayons or paints, drawing on the face, clothing and other features.

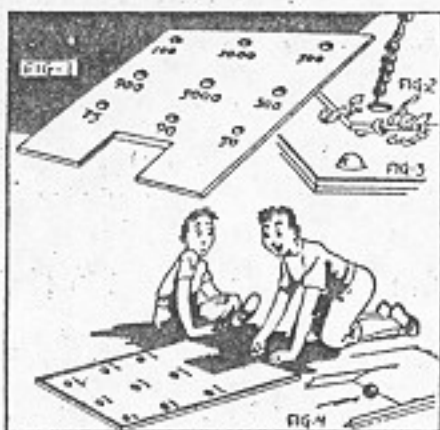


RAINY-DAY MARBLES

You Bore Nine Holes In A Board

When rainy weather forces you to stay indoors for your fun, a marble game will come in handy.

Into a board 12 inches wide, 18 inches long and 1 inch thick, bore nine holes, each one just big enough to receive a marble. With pencil or paint, the value of each hole is designated as in Figure 1. Figure 2 shows how the holes are bored.



They should be made deep enough so that a marble, landing in a hole, will stay there (Figure 3).

At the front end of the board a runway five inches wide must be cut, as shown in Figure 4. The end of the runway must be carved with a chisel so that it slopes gently, thus allowing a marble to ascend to the surface of the game board.

Nail narrow strips of wood on three sides of the game board for a fence to keep badly aimed marbles from rolling off.

Each player gets nine marbles. He takes his place at a tawline five feet in front of the game board. Then he shoots his marbles, one at a time, at the runway. His object is to aim each marble up the runway in such a way that it will roll into one of the holes and, of course, he tries to have it land in the hole of highest value.

After the first player has shot his nine marbles, his score is noted on a score card. Then the next player shoots nine marbles. The player who scores 15,000 first is the winner.

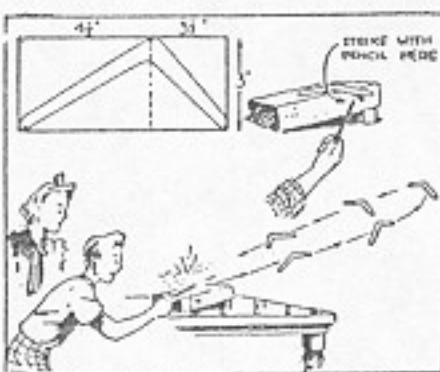
If you wish, you can make the game harder to play by resting the board on a slant. To do this, put a thin book under the back end.

CARDBOARD BOOMERANG

It Will Sail Back To You

Here's how to make a boomerang.

As every boy and girl knows, the peculiar quality of the boomerang as used by native hunters of Australia is that, when thrown, it sails forth through the air and then comes whirling back to its sender. I want to show you how to make one of these strange devices out of cardboard.



The cardboard should be sturdy, and eight by three inches in size. Lightly draw on it the outline of the boomerang as shown in our drawing. Make one blade $3\frac{1}{2}$ inches long and the other $4\frac{1}{2}$ inches long.

Use scissors to cut the boomerang out. It is then ready to use.

Rest a candy box or a book on a table, with another box or book under it to tilt it upward. Place the boomerang on the box, allowing about two inches of the long blade to project. Strike this blade sharply with a pencil.

This will cause the boomerang to sail forward. If you have hit it correctly, it will circle and return to you, landing at or near your feet.

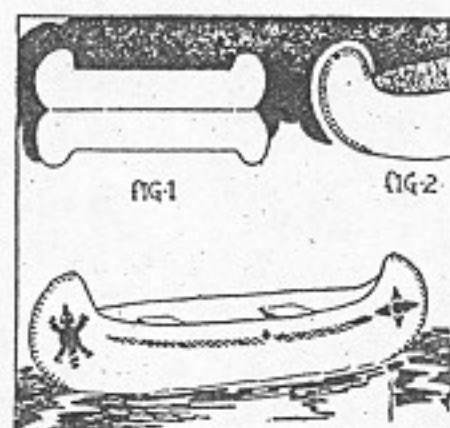
If objects such as furniture are likely to interfere with the boomerang's flight, hold the candy box tilted in your hand about chest high and strike the boomerang from that point.

BATHTUB CANOE

You Can Make A Whole Fleet

Out of some fairly stiff paper you can make a miniature canoe which can be successfully floated in the bathtub. A fleet of them can be easily made.

Cut a two-sided pattern for the canoe as shown in Figure 1. Decorate each side with paints or ink and then fold the paper along the center and sew the sides together at the ends with a buttonhole stitch as illustrated in Figure 2.



If you dip the whole canoe into melted paraffin, it will become waterproof and will float on water.

Best way to apply the paraffin, which becomes very hot and therefore demands caution, is to melt it in a deep pan and then drop the canoe into the liquid and stir it around with a spoon. When the entire canoe has been covered, lift it out with the spoon and place it in another pan until the paraffin on it has hardened. Do not touch hot paraffin with your fingers.

For seats in the canoe, which will hold the sides apart, use small strips of cardboard.

ALPHABET TEST

This is a good game to play on the way home from school.

Going through the alphabet from A to Z, think of one word starting with each successive letter. Allow yourself five minutes.

If two of you are playing (or more than two), the letters of the alphabet fall to the players in rotation, the first player taking A, the next B, and so on. When a player takes more than 15 seconds to think of a word, he must drop out of the game. The winner is the last player remaining.

DRAW-A-WORD PUZZLES

Here's a new kind of fun: Draw-a-Word Puzzles. It's great sport to solve them!

You discover the answer to a puzzle by drawing some simple little pictures. You do not have to have any skill as an artist to make the pictures. Any boy or girl can draw them.

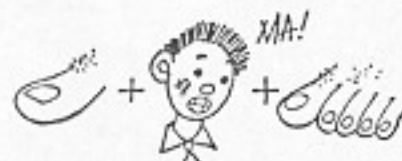
Draw-a-Word Puzzles for you to solve appear on some of the pages of this book. Here is what they are like and how you can solve them:

In presenting a puzzle, I will describe a word. For example, I will say, "This word is the plural of a vegetable." Then I will say, "Draw the picture of a big toe." Next, draw a picture of a boy calling "Ma!" Finally, draw a picture of several toes.

Then I will ask, "What are the vegetables?"

It won't take you long to shout the answer, because there it will be in your sketches, right before your eyes.

In the case of the toes and the boy calling "Ma!" your drawings will look something like this:



Now, then—what's the answer? Of course—*tomatoes!*

Look for the Draw-a-Words on other pages and see how many you can solve. Under each puzzle you will find the answer, printed upside down. But don't look at it until you've finished the puzzle.

Make up some Draw-a-Words of your own and, just for fun, try them out on your pals at school.

DRAW-A-WORD

This is the name of a well-known poet: Draw the picture of a very, very tall man. Who was the poet?

(mopps/duo7)

HANDY WATER SPRAYER

Make This Useful Device For Mother

Few things are as much fun for boys and girls as being able to spray water. There's something fascinating about blowing a fine, mist-like spray into the air even though it is aimed at no particular object.

That's why this handicraft project is a popular one. It's a water-sprayer which any boy or girl can make in hardly any time at all.

Aside from being fun to use, it is also practical for such tasks as sprinkling Mother's washing at ironing time.

All you need is a large bottle with a cork, two big turkey quills or other thin, hollow tubes, and a pocketknife.

You must first cut away part of the top of the cork, making a shelf. Then you must make a horizontal hole through the cork and a vertical hole. These holes should be just large enough to receive the quills or tubes. They can be bored with a fine-bladed knife.

Force the quills into these holes, causing the tips of them to meet, as shown in the lower left-hand corner of the illustration. The vertical quill should extend about five inches below the cork.

The bottle should be almost full of water. Put the prepared cork into it, with the vertical quill extending down into the water. Place the horizontal quill to your mouth, and blow into it. The air will enter the vertical quill and force water up. The water in turn will be sent forward from the bottle in a spray as you blow through the horizontal quill. When the water level falls below the end of the vertical quill you must put more water into the bottle.



FUN FOR YOUR GANG

Play "Now You See It—Now You Don't"

For a whole gang of kids to play there's nothing that beats "Now You See It—Now You Don't." Every boy or girl ought to make the outfit and have it on hand.

Out of old newspapers and magazines clip pictures of all kinds of things, selecting the larger figures that can be most easily seen from a distance.

Glue 15 or 20 of these in scattered formation on a big cardboard such as the top of a suitcase.

One player holds the picture-board for the others to see. Allow them to gather around as close as they wish.

At the end of half a minute, the player holding the card should turn it away from the players so they cannot see it any more.

Each player must then write a list of all the things he can remember having seen. The time limit is four minutes.

If two or more players are tied because they wrote down the same number of articles correctly, have a second picture-board ready for the tied players to look at. The player with the most accurate and longest list wins.



AN X-RAY CARD

It Reveals The Bones In Your Hand

This feather "X-ray" card is really a fake, but it's fun to make and use because with it you seem to be able to see the bones in your hand.

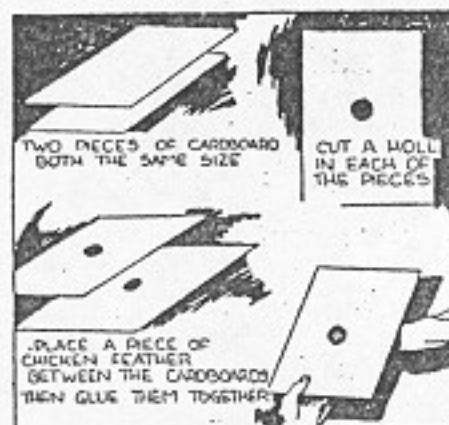
You must have two pieces of cardboard and a chicken feather. First thing to do is cut a round hole about the size of a five-cent piece in each card. Make these holes at the same place in each card.

Next, cut a piece of chicken feather that is a little larger than the holes. Glue the two cards firmly together with the feather between them and over the holes. The device is now ready for use.

Hold the card in one hand and look at your other hand through the feather. The bones in your hand will apparently have become visible to you.

Look through the feather at a pencil and the lead will seem to have become visible, also.

It's an illusion, of course, but fun! Try it on your friends.



JAW-BREAKERS

Say this as fast as you can 10 times: Nickeruckerubblegrub.

Six mixed biscuits, a box of mixed biscuits and a biscuit mixer.

Polly Pepper put pretty pansies in a pretty posy pot.

FOOLISH FUNNIES

Many A Laugh In This Pencil-Pastime

Boys and girls who like to draw can have a whale of a good time with a party stunt called Foolish Funnies.

You need a strip of paper about six inches by two inches in size. Fold it across its width into three equal parts.

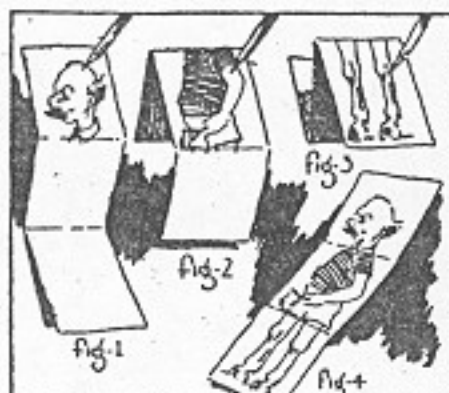
Two or three friends are necessary to play the game. The first player, keeping the paper folded, draws a head of a man, woman, child, animal or bird on the top third of the strip.

When finished, he folds this part under and, without showing it to the next player, passes it on. The second player must use the second third of the strip to draw the body of either a person, an animal or a bird.

When finished, he, in turn, passes the paper back to the first person (if only two are playing) or to a third person (if there are three) who, without seeing the head or body, must draw legs on the last third of the strip.

When he is finished, the entire strip is opened up and the resulting assembly of head, body and legs will be worth a big laugh. Figure 4 shows the possibilities. The first player drew a man's head. The second player, unaware of what the first had drawn, drew the body of a small boy with a slingshot and the third player drew the legs of a horse.

To make it easier to join body to head, and legs to body, it is perfectly fair for each artist to extend the lines of his part of the picture slightly below the fold, as was done in our illustration.



HOME-MADE CHECKERBOARD

You Can Use Buttons For Checkers

A game of checkers played on a checkerboard you have made yourself always seems to have much more zest.

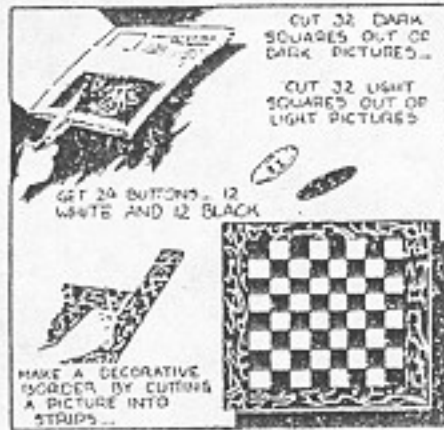
To make your own checkerboard, get a sturdy piece of cardboard about fourteen inches square to serve as the base of the board. Then get an old magazine and out of the colored pictures in it cut thirty-two 1½-inch dark squares and thirty-two light squares of the same size.

Glue these squares next to each other on the cardboard. Arrange them as shown in the lower right-hand corner of our drawing, allowing an inch of space all around the edge of the cardboard for a border.

The border is made by cutting strips one inch wide out of another picture taken from a magazine. Glue these around the edge of the checkerboard. A coat of shellac over the board will preserve it and make it shine.

Get twelve large black buttons and twelve big white ones for "men" and you are ready to play a game.

A home-made checkerboard would be a dandy gift to make for some pal who is ill.



See how many words you can make using only the letters in
CONSOLIDATE

This word is a verb, is pronounced "con-sol-id-ate," with the accent on "sol," and it means to unite.

You should be able to make more than 59 words. Can you?

JAW-BREAKERS

Say this fast 10 times: Chops, steaks, seafood.
Twin screws, steel screws, destroyer.

VEST-POCKET YO-YO

It's Made Of Two Buttons And Some Thread

No matter how many fine toys you have, you can always use another one, and a dandy for either boys or girls to make is a vest-pocket yo-yo.

The yo-yo can be made in about five minutes. Best part about it is the fact that it is tiny enough to carry around in your smallest pocket and therefore is ready for use almost anywhere.

You need only two rather large buttons and a piece of thread.

Sew the buttons together tightly with the curved sides against each other. Tie a piece of heavy thread to the "axle" and wind this thread around and around. The thread should be about two feet long.

Hold the free end of the thread between thumb and finger. Let the buttons drop toward the floor. When the thread is almost all unwound, jerk it upward gently. This will cause the buttons to climb back up. You can keep them going up and down that way indefinitely.



COLOR-VANISHING DISC

Three Colors Disappear When You Whirl It

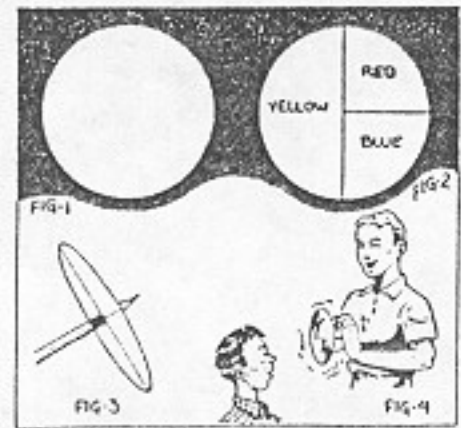
With this device which you can make in a jiffy, you can cause three different colors to disappear almost entirely from the face of a cardboard disc. After you have made one, take it to school and show it to the other boys and girls.

Cut a disc out of cardboard. It should be about three inches in diameter (Figure 1).

With your crayons or paints, color one half of this disc yellow. Then color one quarter of it red and another quarter blue. Figure 2 shows how these divisions of color are arranged.

The third thing is to shove the point of a pencil or a round stick into the exact center of the disc, as in Figure 3. Push the stick through the cardboard in such a way that the disc will cling firmly to it.

The vanisher is now ready. To make the colors disappear almost entirely, simply whirl the stick between your palms as the boy is doing in Figure 4. Have your friends watch the disc. They'll be surprised that the colors become almost invisible as the disc whirls rapidly.



DRAW-A-WORD

This word represents a flower: Draw an automobile. Then draw a map of the United States. What is the flower?

(Continued)

PLAY CALENDAR PITCH

Get A Sheet From A Calendar And You're Ready

When you are looking for something new to have fun with, just get last month's calendar page—if it's a big one—and the problem is solved.

The calendar page, without any preparation of it whatsoever, becomes a game board!

The game is called Calendar Pitch and two players are necessary, although there can be three if a third set of "men" is provided.

The men are simply checkers or buttons. If checkers are used, one player can have the reds and the other the blacks. Each player should have three men.

All you have to do is place the calendar on the floor, face up. The bigger the sheet is, the better, for the big sheets have big number-squares and that makes the game most practical.

Indicate a taw-line five or six feet away from the nearest edge of the calendar. If the calendar sheet is exceptionally large, the taw-line should be even further away from it.

The players stand, one at a time, with their toes touching the taw-line and toss their men at the calendar. The object is to have the men land on the highest numbers. Each player throws three men and then it is the next player's turn to throw his three.

If a man lands on a line between two numbers, the player is credited with the smaller of the two numbers separated by the line.

First player to score 75 is the winner.



RACING PAPER DOLLS

Blow On Them And They Will Move

Paper dolls that "walk" can be made in a jiffy. Races can be held with them.

All you have to do is cut the figure of a dressed doll out of paper. The doll can be about five inches high and three inches wide at the bottom.

Cut a frame around the skirt of the doll. Bend this frame backward gently and fold it lightly. This will act as a brace to hold the doll upright. A face can be drawn on the doll and the figure can be colored.

To make the doll "walk," stand it up on a smooth surface such as a table top. Place your face close to it and blow gently upon the bottom edge of the doll's skirt and the frame. This will cause the doll to slide.

You may have to experiment a bit before you learn exactly how to blow at the doll. If you blow too hard or if your breath strikes the figure too high, the doll will topple over.

That's what makes racing these dolls fun. If each of two players has a doll, they can be set up at a starting line. The first player to get his doll to the finish line wins. If a doll falls over, the player is allowed to set it upright again at the same point and continue the race.



BUTTON BASEBALL

A Good Rainy-Day Game

For a good rainy-day game try Button Baseball. The outfit is easy to make.

For the ball field you need a piece of cardboard 10 inches wide and 15 inches long. This can be obtained by cutting up the top of a cardboard suitcase.

Next, with ruler and pencil, neatly lay out the diagram shown in Figure 1 of the illustration. In addition to the diamond, draw the seven horizontal strips shown in the outfield. Letter the words on the diamond and outfield sections as shown.

Give each player five buttons. Four of these are runners and the fifth is a snapper. Figure 2 shows how to use the snapper to make a runner-button hop forward. Experiment a few times and you will become adept with the snapper.

The game is played much the same as real baseball. There are two teams, each represented by one player. There are nine innings and a team is retired for an inning when it has made three outs.

To play the game, place a runner-button at the home plate and, pressing on its edge with the snapper, try to cause it to land in one of the outfield sections good for a one-base hit, two-base hit, three-base hit or a home run. Try to snap the runner-button so it will not land in the infield sections marked "Strike" or in one of the three outfield sections marked "Out." If the button lands in one of the two areas near home plate marked "Foul Ball," shoot again. If it lands within the diamond where the words "Try Again" appear, shoot again.

You will note that in the outfield there are seven "landing places" which are good for a home run. Six of them are marked



"H. R." Aim for them.

If a player gets a one-base hit, he places one of his runner-buttons on first base. If he should get a one-base hit with his next runner-button, he advances the first runner-button from first to second and places the new runner-button on first, and so on until he scores some runs or is retired by outs.

WISHBONE FUN

Make A Leaping Lena

What do you do with the wishbone of the turkey or chicken you have for Sunday dinner?

Nothing? Well, rescue it before it is thrown away. Out of it you can make a Leaping Lena.

A Leaping Lena is simply a wishbone fixed up with string and a small stick so that it will leap high into the air.

Loop a piece of string rather tightly over the open end of the wishbone. Between the two lengths of string insert a small stick about as long as a toothpick and as thick as a match.

With this stick twist the string around and around until it is wound up. The ends of the wishbone will be pulled slightly toward each other as you do this, so be careful or you may break them.

When the string is wound up, adjust the stick so one end of it barely touches the closed end of the wishbone. The Leaping Lena is now ready.

Holding the stick in place, put the wishbone on a table. Release it—stick and all. The stick will fly around. This will cause the wishbone to pop into the air.



BALANCE A FEATHER

It's An Art You Can Learn

Every boy and girl who has ever seen a circus knows how fascinating it is to watch a balancing act.

The art of balancing looks like it might be hard to master and it really is until you have practiced. But with practice any boy or girl can learn the knack and be able to amuse friends by balancing such things as long feathers and long pieces of tissue paper on the hand, the nose and the chin.

Feathers and strips of tissue paper are especially easy to balance because they are of light weight and fall more slowly than heavier objects. This gives the balancer time to move quickly forward or backward or to one side and thus bring the feather again into an upright position. A good balancer can keep a feather on his nose or chin for as long as two or three minutes.

Our illustration gives you an idea of how to balance a feather and how to fold a long strip of tissue paper so it can be balanced on your hand—or your nose or chin, for that matter.

Learn to balance a feather. It's fun!



CROSSPATCH GAME

Hours Of Fun With Pencil And Paper

On a sheet of paper print a lot of numbers (Figure 1). There must be two of each number, but the numbers of each identical pair must be located as far apart as possible. Any numbers you wish can be used.

When the sheet has been well covered with numbers the game is ready to start. Each player must have a pencil. Players take turns.

A player selects any number he wishes and then must draw a line from that number to its duplicate. The line he draws must not cross any other line on the sheet, nor can it pass through any other number than the one which is his goal.

The first player who finds it impossible to connect two identical numbers without crossing a line or passing through another number is the loser.

One line can be made to parallel another line, but no lines can cross. Impress this upon each player.

If you wish, each game can count 10 points. First player to win three games, or 30 points, becomes champion.



JAW-BREAKERS

Tommy Thrasher thought Tillie Thresher took Theo's thimble to the temple tower.

Say "little Lulu" as fast as you can 10 times.

Shallow shores show some signs of sunshine.

Baits his hook and hates his book.

Five flies can fly faster than five fleas.

Baby Blue buys big balloons.

Sally said Sue shot Sam.

Fat Fred fell flat.

Say "awful easy" as fast as you can 10 times.

Cracker casks creak queerly.

Betty Brindle bent brass bands backward.

Say "riddle river" as fast as you can 10 times.

Flighty Fannie forgot Fred's fresh fish for Friday.

PASTE-UP NOTES

You Clip Words Out Of Newspapers And Magazines

Some day when you want to write a letter to a friend, send a "paste-up note" instead of writing by hand. Such a letter, as shown in our illustration, is composed of words clipped out of newspapers and magazines and then pasted upon a sheet of paper to make complete sentences.

The words are clipped out of headlines and advertisements. It is a good idea, in order to have plenty of words to use in your letters, to clip out about 20 every day, all in different kinds of type. So they will be neatly sorted when you want to compose a letter, put all the words starting with "A" in one envelope, all those starting with "B" in another, and so on. You will require 26 envelopes, one for each letter of the alphabet, and, of course, they'll become pretty fat with clippings after a



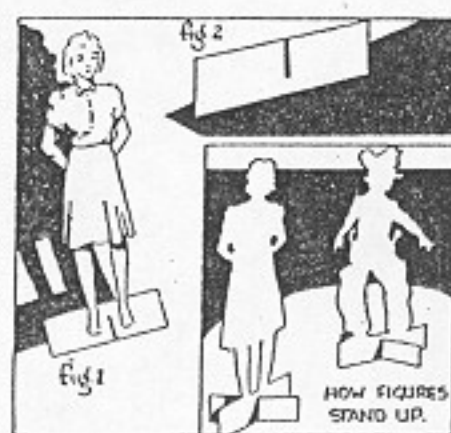
week or two.

When you want to write a paste-up letter, just get out your envelopes and look for the words that say what you want to say. Paste them on a sheet of paper as shown in the illustration, and in no time at all your letter will be ready to mail.

YOUR OWN MOVIE STARS

You Can Be A Hollywood Director

Boys and girls who collect pictures of their favorite movie actors will find this fun-project interesting. By following the directions you can make a picture stand up on a table or shelf. If you assemble a whole lot of figures you can stand them in groups as though they were waiting to go on the set for the shooting of a picture. You can then be the director and put your actors through their paces.



Full-figure pictures should be clipped from magazines and newspapers. Glue each picture to a piece of lightweight cardboard and then, with scissors, trim the excess cardboard away from around the figure. At the feet leave a panel of cardboard one inch high and 2½ inches long.

In the center of this panel make a vertical cut with your scissors, extending it upward about ⅝ of an inch (Figure 1).

Next, cut another panel, making it the same size. Make a ⅝-inch scissors-cut downward in this panel at the exact center, as in Figure 2.

To make the figure stand up, simply slide the two panels together at right angles.

COMIC-FIGURE STATUES

Use Your Favorite Funny Paper People

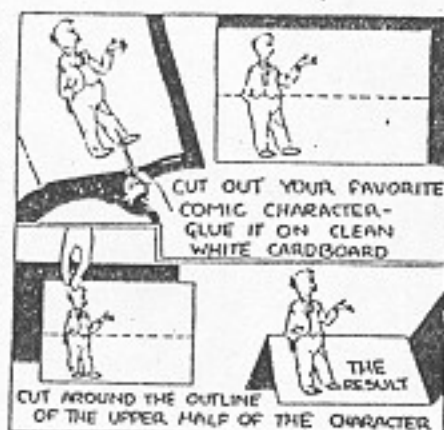
Every boy or girl has a favorite comic-strip character, and here is the way by which you can make little cardboard statuettes of it. They are fun to make and, when finished, you can place them on your desk. If you make enough of them you can even use them for place cards at a party.

Out of the newspaper clip the figure of your favorite comic. Paste it on a piece of lightweight cardboard that will fold easily.

With a ruler find the center point between the top and bottom edges of the card. Beginning at that point, use a sharp knife to cut through the cardboard around the upper half of the comic figure.

When that has been done, fold the upper half of the cardboard back and down. This will cause the upper half of the figure to project above the fold. The part of the card that has been folded back will serve as a brace so the whole figure will stand up. Color the figure with crayon or paints.

After making one figure you can easily make a whole family of comic characters.



ROOT-ROT

KURT SAXON'S ANSWER TO ALEX HALEY

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ROOT-ROT

KURT SAXON'S ANSWER TO ALEX HALEY

ROOTS, by Alex Haley, is a slander against all white Southerners during the days of slavery and has caused humiliation to all their descendants as well as feelings of guilt among many whites whose ancestors had nothing to do with slavery. ROOTS is also a disservice to blacks, causing them resentment of whites and a false pride in their own ancestors as well as a belief that they are somehow in bondage here, rather than living the good life in their native homeland.

As a descendant of Southern whites, I have written an answer to Haley's slanders and compiled eleven articles and stories from the 19th Century on the real slave trade and slave life in the American South.

Kunta Kente, a devout Moslem, born in 1750 in the village of Juffure, four days upriver from the mouth of the Gambia in West Africa was captured about 1770 by whites. This fable has been presented to Americans in the foolish account, "ROOTS", by Alex Haley. Now in its second showing as a TV series to millions of credulous whites and blacks, it is calculated to instil pride and anti-white hatred in blacks and guilt and self-hatred in whites.

Elaborate in detail, as are most accounts written in the Big Lie style, it is so full of holes that any objective scholar would reject it in its entirety. However, since few objective scholars are also publishers these days, the lie has remained relatively unchallenged. Worst of all, the non-objective scholars are so cowed by fears of being stigmatized as racists that anything some boorish lout writes against his betters must be tolerated.

Aside from such considerations, proof to the contrary is simply unavailable to most modern scholars. So much has been lost that only a collector of 19th century accounts has the real facts to refer to. Others have to look to modern accounts by liberal idealists, so prejudiced in favor of the underdog that they are blind to their own long-range interests.

The most amazing thing about this whole fable is Alex's arrogance in omitting documentation. Small wonder, since slaving was extremely unpopular with those not engaged in the trade. It is understandable, therefore, that records were sketchy and seldom preserved after the transactions of captains and shipowners and/or captains

and slave dealers were completed.

On talk shows, Alex has related questioning surviving relations, collecting letters, etc. His freed ancestors left the plantation at the end of the Civil War and we are to believe that the plantation records still exist intact.

In the chaos of the Reconstruction, ex-slave owners would have had little reason to preserve such records. I doubt if one out of a thousand American blacks can trace his ancestry back to any plantation.

But even if Alex could fix that location, there would be no mention of Kunta Kente in any records. Slaves were not named, or even numbered by the ship's captains. His master changed his name so "Kunta Kente" would never have been written down.

His slave descendant, Kizzy, was supposedly taught to read from the Bible by her playmate and mistress. But this doesn't mean she could write. Nor would Kizzy have dared to write the family history, as literacy among slaves was usually strictly forbidden.

Illiterates, constantly oppressed and beaten, never going more than three minutes at a time without some traumatic humiliation (if you believe the story) would have no reason to preserve a family legend. I should suppose slaves had better things to think about than the ravings of a mad ancestor.

It would be easy, but tedious and unrewarding to nit-pick and dissect each inaccuracy, page by page. But for instance, I cite Alex's reference to "a pile of books" on a shelf by his grandmother's bed, (ROOTS, page 25) left by his grandfather many years before. Only the wealthy could afford to own books in those days and anyway, tropical mildew would have destroyed them in a season. But let's call this "author's licence".

As a naturalist, Alex is pathetic, as on page 31 of ROOTS he tells of a termite mound being broken into and thousands of termites pouring out to get away. They would retreat further inside and only soldiers and builders would rush to the break. No matter. To contradict more such unimportant absurdities would only be boring.

Going from the book to the TV series; the Mandinkas (if such a tribe existed) were presented as a brave, clean, strong people, loving in peace and

fierce in war. They lived the idyllic life of farmers and goatherds. Chapter 16 of the book shows many in the tribe were slaves, which Alex excuses as being merely the equivalent of sharecroppers. The TV series omits this part, leading the audience to believe that slave owning of any kind would have been abhorrant to Kunta's people. Besides, no one who reads the article on black slave owners in the Congo (page 10) could take the sharecropper line seriously.

Actually, slavery was a black African institution accepted and practiced by them for thousands of years. Even so, as Moslems, the Mandinkas would have been exempt from enslavement.

The Arabs, although not present in the book, considered all heathen fair game. However, those blacks who were converted to Islam were either let alone or used to capture their infidel black brothers for the slave trade. All Moslems are brothers and even whites left black. Moslems alone, lest the Arabs protest, which they would have. Since the whites depended on many Arab slavers to supply them with their human chattels, picking up black Moslems would have been more a nuisance than it was worth.

Further, there is no evidence of Moslem influence in the American slaves' religions. They were invariably practitioners of black magic and various forms of African witchcraft. This alone, casts further doubt on Alex's account, since, although Kunta Kente could read and write in Arabic and prayed five times daily to Allah, his tribe's customs were ridden with heathen superstitions.

"There is no God but Allah and Mohammed is his prophet", is the basic tenet of Islam. No real Moslem convert would be allowed to retain the heathen rituals of his ancestors. As the early accounts show, (page 5) there were Moslem tribes in Gambia, but Kunta's people would not have been among them.

Kunta's grandmother, on page 67 of ROOTS, tells him that during her girlhood (possibly 40 years before, or about 1730) whites invaded her village and captured her. The first ship of whites which had penetrated the region since 1660 was commanded by a Captain Stibbs in 1723 looking for gold, not slaves (page 6).

The idea of whites capturing slaves in the first place, is ridiculous. The interior of Africa was often fatal to whites. Only explorers, missionaries and gold hunters ventured beyond the coasts. Their mortality rate from tropical diseases was high and in Gambia the climate was only "fairly

healthy during the dry months" (page 5).

Slaves were purchased from black chiefs or Arab slavers. Their cost was from pennies to maybe a pound, depending on from which group they were purchased. A string of beads for one, a bottle of rum for another, a couple of yards of cheap cloth for another one. Their cheapness, coupled with the fact of their 50-50 chance of living to be sold in the Americas (page 7) is a virtual guarantee that no whites would risk a spear in the guts or fever to capture slaves themselves. Besides, ship crews were minimal, so the captains would have been short-handed if crewmen were lost. It simply wouldn't have been worth the trouble from any point of view.

The account of about twenty slave ships moored upriver (ROOTS, page 70) is further nonsense, as slavers did not congregate in fleets. Although the British owned slaving companies, slavers were mostly individual ships, regardless of how many a company might own, with independent captains under contract. There may have been twenty ships anchored at the mouth of the Gambia at Bathurst, but not upriver. Besides, slave raids would not have been held during the rainy season and the Gambia has a dry season depth of only 13 to 20 feet, hardly deep enough for slavers with a load of human cargo (page 5).

Page 70 of ROOTS also gives an account of the king of Barra leading his soldiers against a fleet of slavers and burning them to the waterline and killing all their crews. This is an absurdity hardly worth repeating except as a story for children.

It is not likely that any slavers operated around Gambia as the trade was largely restricted to areas further south and conducted by agents. The story, "Negroland and the Negroes" (page 27)

is not particularly interesting but it does show that coastal tribes were not often bothered by slavers. It also illustrates the discomfort of whites, even on the coast.

Not all Africans were involved in slavery. The Krus were neither enslaved nor were they slave owners. They did own women called "wives", although a chief who owned 3000 women and called them wives was stretching a point as far as the women themselves were concerned. But owning women was hardly different from owning slaves.

Alex's account of the Mandinkas paints a picture of misery and starvation only the hopelessly nostalgic could relish. His claimed ancestors were in worse shape than the sorriest American Indian tribe. Starvation, drouth, wet, insects, slavery, constant terror, was hardly a pristine

utopia from which the noble savage would develop.

Recent visitors to the area he claims as his ancestral homeland describe the natives there as the most wretched of people. I should suppose any ghetto dweller in New York would consider himself well-off by comparison.

Furthermore, upon reading the account of slavery by blacks in "The Slave Trade in the Congo Basin", his arguments against the whites who bought slaves as being brutes, is pretty thin. Compared to the black slavers, the whites were benign.

Actually, the Africans lent themselves to enslavement by whites. Since they had no feelings for their fellow Africans, is it any wonder that both Arabs and whites considered them fair game? After all, if these poor creatures were doomed to the most miserable, torturous existence, if they were allowed to live at all, could slavery in America or an Arab state be worse? And those who made it to America were far better off than those who remained captive servants in native villages.

Alex may have known something of these conditions so relocated his mythical ancestors to a less harsh setting. But placing them in Gambia was the most clumsy grasping at straws. His real ancestor was most likely some pitiful Congolese woman who would have been butchered and eaten if her black captor hadn't been offered a bottle of rum in trade for her.

Although I wish no slave had ever been brought to America, any black can only be thankful that his ancestor was sold to the whites. Hating modern whites for what a few of our ancestors did is a form of insanity. I'm sure no American black would trade places with the average modern black African.

Alex writes against the slavers with great bitterness. But would he want to have been reared as was the fictional Kunta Kente? Kunta was brought up in a truly totalitarian system. His every hour was controlled and regimented as strictly as is that of any Chinese living under modern communism. His time, his thought, his life, was not his own. All was tradition, conditioning, molding, regimentation.

Where, in all that, was the real Kunta Kente? The TV series and the book shows the captive Kunta a borderline psychotic with no identity of his own. He could not adapt since he had never made an important decision for himself. It's little wonder he proved to be a mental defective.

Had he been reared in America with its lax discipline, his insanity would have gotten him committed to an institution. That he was indeed insane can be shown by comparison with the other slaves on the plantation. They had adapted. They were normal. He couldn't, so he wasn't normal at all.

Lest his rebelliousness in the face of all the odds be attributed to strength, consider this analogy: Suppose you were captured and carried off to Outer Mongolia and sold to a village chieftan. There, you meet others of French, German, Polish and Italian nationalities. You know only English and they can't communicate to you or each other except in snatches of Mongolian.

Your master names you Oom Tang. You insist you are George Blake. Whack. "Oom Tang". "No, George Blake". Whack. "Oom Tang". "George Blake". Whack.

You pick up a little Mongolian and your fellow slaves tell you to settle down. Cooperate. They're doing all right under the circumstances. They're not chained or beaten. They're not trying to run away. Where can they go? They tell you this but you run anyway. You're beaten. You run again. Your toes are chopped off. What are you proving?

This isn't happening to the others. They're not weaklings or cowards. But maybe you are. Maybe you're just plain nuts. Should a descendant; a respected Amero-Mongolian scholar, Toirin Salatu, write a 729 page book of nonsense about the heroic American, George Blake? That, in itself, might be a kind of insanity if it were meant to be believed.

But then again, your descendant becomes wealthy and goes on Mongolian TV. So all you got out of it was a hole in the ground and dirt shoveled in your face.

ROOTS has proven to be the greatest racist con since Uncle Tom's Cabin. But it gives me the greatest pleasure to show the other side. I was raised mainly in the North, but my roots are in Arkansas. So I grew up knowing all sides as few others are privileged.

Rather than go further and dispute the Kente clan's misadventures in the American South, I'll let my own ancestors and their Northern brothers tell it like it really was. The following articles were all printed in Yankee publications during and soon after the Civil War.

They had no axe to grind. They wrote of what they saw. They weren't writing to us. But their version of Africans, slave life and the Southerners' attitudes towards blacks were first-hand and

objective.

They were good people, for the most part. There was a Simon Legree here and there but such were not typical, as they are depicted in *ROOTS*. Slave owners were as much a part of the system as were their slaves.

In the hotter regions of the deep South were agribusinesses with their monocultures of cotton, sugar cane, etc. Their owners had little personal contact with the slaves and so were often unconcerned with their treatment. The work was brute labor and mainly reserved for brutes. Blacks with the intelligence to do regular work around the farm or in the home were too valuable to waste in such occupations.

Slaves who were too stupid, lazy or uncooperative to work around the farm were sold to such plantations. There was the whip swinging overseer, usually black. Kunta Kente would most certainly have been sold down the river to the cane fields.

It was in these agribusinesses where slaves were most likely to run away. They were the ones for which most reward posters were printed. The average slave owner had no interest in catching runaways from such places, hence, the incentive of a reward. Even rewards were not enough for many decent slave owners to become involved so there were professional slave catchers operating on the same basis as the bounty hunters of the old West.

It was also on these huge agribusinesses where families were separated. The owners of the kind of plantations shown in *ROOTS* seldom broke up a family unless forced to by economic necessity.

They knew their slaves as people and were as considerate of their well-being as any decent employer of today. They wanted to keep them happy and breaking up the family would have insured only resentment from the other slaves and nothing but trouble from then on.

In the following reprints, the 19th century encyclopedia descriptions of Gambia make no mention of slave trading in that area. The excerpts on the Negro (page 8) gives no hint of Moslem slaves in the Americas.

The Yankee explorer who wrote "The Realm of

the Congo", showed nothing but contempt for Africans and displayed attitudes not reflected by the slave owners in the other articles. The story was mainly of exploration and I have reprinted only relevant excerpts.

Read and judge for yourself. You can but conclude, as I do, that the whites in *ROOTS* were

caricatures and composites of the worst of the slave owners and not at all representative of the average.

"Aunt Eve Interviewed", tells of a beloved exslave and her fond recollections of slave life during Colonial days.

Slaves were generally respected, loved and well cared for. Bible Smith, of "The Poor Whites of the South", so loved his slave, Jake, that he apparently named his son after him.

The writer of "Education of the Colored Population of Louisiana" was a Yankee liberal of his day and properly points out that there were black slave owners in Louisiana, just as pro-slavery as any white slave owner. I cut the article off after the relevant information had been covered.

Yankee writers of the last century had good reason to resent Southerners, but I found no stories by them reflecting the constant brutality and downright meanness of whites depicted in *ROOTS*.

The clergyman who bought a plantation may seem a rascal, but he offered no threats of force to his slaves. By his thinking, he was showing genuine concern for his charges.

Oby, of "The Freedman's Story", was torn between real love and respect for his master and his yearning for an uncertain freedom. In September of 1864, Sheridan defeated Early and liberated northern Virginia. Oby crossed the Union controlled lines in October and got work with a Sutler. Being too frail for this, he hired on as a house servant. By late 1866 he could read well enough to see that De Vere had the story straight.

Young Miss Broome of the fictionalized, "How Sal Came Through", was genuinely concerned with her friend-slave, Sal and wanted her to practice Christian forgiveness towards a plantation rival.

Excerpts from the "Monthly Record of Current Events" for 1864-65, gives the main points of the debate on arming the slaves to fight against the North during the close of the Civil War. The fact that this issue was up for debate, in the first place, should be proof that the slaves were trusted to be loyal to the system by most, even though they were generally believed unqualified through lack of training and the lack of time involved. Had Alex's characterizations been accurate the arming of slaves would never have come up for debate.

CHAMBER'S ENCYCLOPEDIA — 1891

GAMBIA

Gambia, a river of Western Africa, the more southerly of the two great streams of Senegambia, enters the Atlantic after a course estimated at over 1400 miles, by an estuary which in some parts measures nearly 27 miles across, but contracts to little more than 2 at the mouth (Bathurst, 13° 24' N. lat., 16° 36' W. long.). It is navigable from June to November for vessels of 150 tons up to Barraconda, about 400 miles from the sea. The whole of the *lower* river, extending to Georgetown, 180 miles from Bathurst, is British waters. Below Barraconda the river overflows its banks in the rainy season, and, like the Nile, leaves a fertile deposit of mud.—The British settlement of Gambia occupies the banks of the river as far up as Georgetown, though not continuously. Its actual area is about 69 sq. m., embracing St Mary's Island, a sandbank about 3½ miles long by 1¼ broad, mostly covered with low swamps, but containing Bathurst (q.v.); British Combo, on the mainland opposite; Albrida, on the north bank; the Ceded Mile; and M'Carthy's Island, with Georgetown. The climate is officially described as only 'fairly healthy during the dry months.' Besides the weaving of cotton into native cloths, there are manu-

factures of vegetable oils and bricks, and some boat-building. The staple product is the ground-nut, which is exported to the south of Europe for the extraction of oil, although this trade has declined since 1858. Other products are hides, rice, cotton, beeswax, kola nuts, and india-rubber, and there is an active entrepôt trade with the neighbouring French settlements in cotton goods, spirits, rice, kola nuts, and hardware. In the ten years 1878–87 the imports (mostly British) ranged from £217,938 in 1884 to £69,243 in 1886; the exports (chiefly to France) from £254,711 in 1882 to £79,516 in 1886. The revenue in the same period ranged from £28,952 to £13,453, but the expenditure never fell below £18,361. Formerly a dependency of Sierra Leone, the settlement was created an independent colony in 1843, and became a portion of the West African Settlements in 1876; in 1888 it was made a separate government. The settlement is connected with Europe by telegraph cables, and the Liverpool mail-steamers call fortnightly. There are 14 denominational schools (8 Mohammedan), receiving grants in aid, with about 1300 pupils. Pop. (1881) 14,150, including some 25 Europeans.

ENCYCLOPEDIA BRITANNICA — 1892

GAMBIA, **GAMBRA**, **BA DIMMA**, or **FURA**, an important river of Western Africa, which enters the Atlantic about 13° 50' N. lat. Its sources are in the central plateau of the Futa Jallon highlands, a tract of country about 240 miles inland, which also contains the head waters of the Senegal, the Faleme, the Rio Grande, and some tributaries of the Niger. Flowing almost due N. for the first 200 miles of its course, it turns somewhat abruptly to the W., and continues in that direction through a country of great fertility. Steamers can proceed up the river as far as Yaba Tenda; the channel remains navigable for boats 300 miles from the mouth to the falls of Barraconda; and above the falls it is again navigable, as was shown by Governor Macdonnell's expedition in 1851, for at least 160 miles farther. The principal affluent is the Neripa, which, coming from the north, joins the main stream about 30 or 35 miles above the falls. At Fattatenda, a short distance below the falls, the river has a breadth, even in the dry season, of about 320 feet, with a depth of from 13 to 20 feet. In the rainy season it rises from 20 to 50 feet, and the whole country downwards to the sea is laid under water, and receives a rich alluvial deposit.

The British colony of Gambia comprises a considerable territory mainly on the left bank at the mouth of the river, Elephant's Island about 100 miles from the sea, and MacCarthy's Island still further inland. The whole area under British authority is 21 square miles. The population in 1851 was stated at 5693, in 1861 at 6939, and in 1871 at 14,190 (7306 males and 6884 females). In the 15 years from 1860 to 1874 the total gross revenue was

£268,232, making an annual average of £17,802; and the gross amount of public expenditure in the same period was £255,291, making an annual average of £17,019, or a total surplus of revenue over expenditure of £2941. In 1862, 1863, and 1864 the liabilities exceeded the assets by £3638, £4817, and £5492 respectively, but there is no funded debt. The Gambia settlement, which formerly cost the imperial revenue from £20,000 to £25,000 per annum, now provides for its own defence,—an armed police force, recruited mainly from the Mahometan tribe of the Houssas, having been substituted since 1869 for the imperial troops. The parliamentary grant, which had averaged about £4200 per annum from 1860 to 1867, was reduced to £1500 in 1868, and finally withdrawn in 1871, and all expenses are met by the local revenue. The Gambia district was originally united with Sierra Leone on the dissolution of the African Company in 1822; in 1843 it was made a separate colony, the first governor being Henry Frowd Seagram; in 1868 it was reunited to Sierra Leone; and it is now governed by an administrator. The capital of the colony is Bathurst, a town on the eastern side of St Mary's Island.

St Mary's Island lies at the mouth of the river on the south side, close to the mainland, from which it is separated by a stretch of mangrove swamp and a narrow arm of the river called Oyster Creek. It is about 15 miles in length by less than a mile in breadth, and consists of a slightly elevated plain of sandy soil, which in the dry season becomes a bed of hot and shifting dust. There are naturally not many trees on the island, though a few cocoa-nuts,

palms, papaws, willows, bananas, oleanders, and guavas manage to maintain a precarious existence. The Barbadoe pride, however, flourishes luxuriantly (Captain Hewitt). Bathurst is on the whole a well-built town, the principal material employed being a dirty red sandstone coated with whitewash. It lies about 12 or 14 feet above the level of the river. The market house is built of iron, and the market place was planted with trees in 1869. Besides the Government house and the barracks, there is a hospital founded by General Macdonnell, a court-house, and an Episcopal church completed about 1869. The population of the town is of a very motley description, including, besides the white officials, and traders to the number of about 50, half-castes of all shades, liberated negroes, Jolloffs, Barras, and other local tribes. The part of the mainland immediately contiguous to St Mary's is known as British Combo, an area of about 6 miles long by from 2 to 3 miles broad having been secured by treaty with the king of Combo in 1853.

M'Carthy's Island lies about 180 or 200 miles above St Mary's. It is about $5\frac{1}{2}$ miles in length and 1 in breadth. There are two or three "factories," a considerable trading town, peopled partly by liberated Africans, a fort, a Methodist church, and a schoolhouse. Though this was the last spot actually in British possession, it was long understood by Gambia traders that they were under British protection much farther up the stream; but, according to the despatches of Lord Carnarvon in 1877, they must proceed at their own risk as soon as they advance beyond British territory. St James's Island, which was the seat of the British factory in the 18th century, is about 17 miles from St Mary's. It still bears traces of European occupation, but is gradually being washed away by the river.

The chief exports are ground nuts, wax, hides, ivory, gold dust, palm oil, and gum arabic; but even these are obtained in quantities that look ridiculously small when the natural richness of the country through which the Gambia flows is considered. At the close of the 18th century only two or three ships were employed in the trade; in 1839 no fewer than 239 merchant vessels visited the river; and in 1871 75 British and 154 foreign vessels entered, with a total tonnage of 51,853 tons. During the four rainy months, from July to October, the native trader conveys his employer's rice or corn up the river, and receives in exchange the pagnes or country cloths; in November he barter these same cloths for ground nuts, hides, and wax; and for the rest of the year, till the rainy season comes round again, he supplies the natives with arms, powder, rum, Madras handkerchiefs, and other European productions. The French traders, however, who are gradually getting a large share of the commerce into their hands, have introduced the custom of money transactions, and the innovation is well received by the natives.

The trade in ground nuts is of comparatively recent development. In 1836 the value exported was only £838; in 1837 it reached £8053, and in 1840 no less than £15,209. In 1860 the value was £79,611, and in 1861 £101,060. The average quantity between 1850 and 1860 was 11,196 tons; between 1870 and 1877 it was 14,000 tons. The supply is greatly affected by the political state of the country in which the nuts are grown. Most of the necessary tillage is performed by the tribe of the Sera-Woullis, who come down from the interior in great numbers, and return home when they have earned what they desire. The French markets are the principal destination of the nuts. American traders deal mainly in hides, horns, and beeswax; and the honey is chiefly purchased for the German market. The Roman Catholics maintain a mission and a small convent in the Gambia, and the Wesleyans have long had a number of stations. The latter have done great service to education in the colony,—their 10 schools, as far back as 1860, being attended by 1273 scholars. It was not till 1869 that, even at Bathurst, a Government school was established; but there are now several schools in connexion with the Episcopal church. The Roman Catholics began the erection of a large schoolhouse in 1873.

The Gambia was visited by the Carthaginian explorer Hanno,

and it became early known to the Portuguese discoverers; but it was not till 1618 that English traders began to turn their attention to this quarter. In that year a company was formed for the exploration of the river. Richard Thompson was sent out in the "Catherine," and succeeded in reaching Kassar, a Portuguese trading town, but he never returned, and his fate is not known. Two years afterwards, Richard Jobson advanced beyond the falls of Barraconda; and he was followed, about 40 years later, by Vermuyden, a Dutch merchant. In 1723 Captain Stibbs was sent out by the African Company to verify Vermuyden's reports of gold; he proceeded 60 miles above the falls. The treaty of Versailles in 1763 assigned the right of trade in the Gambia to Britain, reserving the single port of Albreda for the French; while at the same time it assigned the Senegal to France, and reserved the port of Portendic for the British. By the treaty of Paris in 1763 this arrangement was re-established, and it remained in force till 1857, when an exchange of possessions was effected, and the Gambia became a purely British river. In 1870 there was a proposal to transfer the colony to the French; but it led to nothing more than a voluminous diplomatic correspondence.

THE AFRICAN SLAVE TRADE ENCYCLOPEDIA BRITANNICA 1892

The first Englishman who engaged in the hateful traffic was Captain John HAWKINS (q.v.). The English slave traders were at first altogether occupied in supplying the Spanish settlements. Indeed the reign of Elizabeth passed without any English colony having been permanently established in America. But in 1620 a Dutch ship from the coast of Guinea visited Jamestown in Virginia, and sold a part of her cargo of negroes to the tobacco-planters. This was the first beginning of slavery in British America; the number of negroes was afterwards continually increased—though apparently at first slowly—by importation, and the field-labour was more and more performed by servile hands, so that in 1790 the State of Virginia, which is only a small part of the original colony so named, contained 200,000 negroes.

The African trade of England was long in the hands of exclusive companies; but by an Act of the first year of William and Mary it became free and open to all subjects of the crown. The African Company, however, continued to exist, and obtained from time to time large parliamentary grants. By the treaty of Utrecht the *asiento*,² or contract for supplying the Spanish colonies with 4800 negroes annually, which had previously passed from the Dutch to the French, was transferred to Great Britain; an English company was to enjoy the monopoly for a period of thirty years from 1st May 1713. But the contract came to an end in 1739, when the complaints of the English merchants on one side and of the Spanish officials on the other rose to such a height that Philip V. declared his determination to revoke the *asiento*, and Sir Robert Walpole was forced by popular feeling into war with Spain. Between 1680 and 1700 about 140,000 negroes were exported by the African Company, and 160,000 more by private adventurers, making a total of 300,000. Between 1700 and the end of 1786 as many as 610,000 were transported to Jamaica alone, which had been an English possession since 1655. Bryan Edwards estimated the total import into all the British colonies of America and the West Indies from 1680 to 1786 at 2,130,000, being an annual average of 20,095. But this, he admits, is much less than was in his time commonly supposed. The British slave trade reached its utmost extension shortly before the War of American Independence. It was then carried on principally from Liverpool, but also from London, Bristol, and Lancaster; the entire number of slave ships sailing from those ports was 192, and in them space was provided for the transport of 47,146 negroes. During the war the number decreased, but on its termination the trade immediately revived. When Edwards wrote (1791), the number of European factories on the coasts of Africa was 40; of these 14 were English, 3 French, 15 Dutch, 4 Portuguese, and 4 Danish. As correct a notion as can be obtained of the numbers annually exported from the continent about the year 1790 by traders of the several European countries engaged in the traffic is supplied by the following statement:— "By the British, 38,000; by the French, 20,000; by the Dutch, 4000; by the Danes, 2000; by the Portuguese, 10,000; total 74,000." Thus more than half the trade was in British hands.

² The Spaniards were prevented from forming establishments on the African coast by the Bull of Demarcation ("Inter cetera") of Pope Alexander VI. (1493), which forbade their acquiring territory to the east of the meridian line of 100 miles west of the Azores. They could therefore supply their American possessions with slaves only by contracts with other powers.

"At present," said Robertson, writing in 1791, "the number of negro slaves in the settlements of Great Britain and France in the West Indies exceeds a million; and, as the establishment of servitude has been found, both in ancient and modern times, extremely unfavourable to population, it requires an annual importation of at least 58,000 to keep up the stock." The slaves in the Spanish dominions and in North America, he thought, probably amounted to an additional million.

The hunting and stealing of human beings to make them slaves, which were already practised in Africa for the supply of the central states of that continent, as well as of the markets of northern Africa, Turkey, and other Mohammedan countries, were greatly aggravated by the demand of the European colonies. The native chiefs engaged in forays, sometimes even on their own subjects, for the purpose of procuring slaves to be exchanged for Western commodities. They often set fire to a village by night and captured the inhabitants when trying to escape. Thus all that was shock-

ing in the barbarism of Africa was multiplied and intensified by this foreign stimulation. To the miseries thus produced, and to those suffered by the captives in their removal to the coast were added the horrors of the middle passage. Exclusive of the slaves who died before they sailed from Africa, 12½ per cent. were lost during their passage to the West Indies; at Jamaica 4½ per cent. died whilst in the harbours or before the sale, and one-third more in the "seasoning." Thus, out of every lot of 100 shipped from Africa 17 died in about 9 weeks, and not more than 50 lived to be effective labourers in the islands. The circumstances of their subsequent life on the plantations were not favourable to the increase of their numbers. In Jamaica there were in 1690 40,000; from that year till 1820 there were imported 800,000; yet at the latter date there were only 340,000 in the island. One cause which prevented the natural increase of population was the inequality in the numbers of the sexes; in Jamaica alone there was in 1789 an excess of 30,000 males.

CHAMBER'S ENCYCLOPEDIA — 1891

NEGRO SLAVERY

Negro Slavery existed from the earliest times; the Carthaginians seem to have brought caravans of slaves from various parts of North Africa; but in this the negroes suffered no more than other contemporary barbarians. The negro slavery of modern times was a sequel to the discovery of America. Prior, however, to that event the negroes, like other savage races, enslaved those captives in war whom they did not put to death, and a considerable trade in slaves from the coast of Guinea was carried on by the Arabs. The deportation of the Africans to the plantations and mines of the New World doubtless raised the value of the captive negro, and made slavery rather than death his common fate; while it may also have tempted the petty princes to make war on each other for the purpose of acquiring captives and selling them. The aborigines of America having proved too weak for the work required of them, the Portuguese, who possessed a large part of the African coast, began the importation of negroes, in which they were followed by the other colonisers of the New World. The first part of the New World in which negroes were extensively used was Hayti in St Domingo. The aboriginal population had at first been employed in the mines; but this sort of labour was found so fatal to their constitutions that Las Casas (q.v.), Bishop of Chiapa, the celebrated protector of the Indians, interceded with Charles for the substitution of African slaves as a stronger race. As early as the beginning of the 16th century a good many Africans were already in Hispaniola; the emperor accordingly in 1517 authorised a large importation of negroes from the establishments of the Portuguese on the coast of Guinea. Sir John Hawkins (q.v.) was the first Englishman who engaged in the traffic, in which his countrymen soon largely participated, England having exported no fewer than 300,000 slaves from Africa between the years 1680 and 1700; and between 1700 and 1786 imported 610,000 into Jamaica alone. At first the trade was in the hands of special companies, one of which long enjoyed the special right or *Assiento* (q.v.) from Spain of supplying slaves. Most of the English slaving ships belonged first to Bristol, and from 1730 onwards to Liverpool (q.v.). The slave-trade was attended with extreme inhumanity;

the ships which transported the negroes from Africa to America were overcrowded to such an extent that a large proportion died in the passage; and the treatment of the slave after his arrival in the New World depended much on the character of his master. Legal restraints were, however, imposed in the various European settlements to protect the slaves from injury; in the British colonies courts were instituted to hear their complaints; their condition was to a certain extent ameliorated, and the flogging of women was prohibited. But while slavery was thus legalised in the British colonies, it was at the same time the law of England (as decided in 1772 by Lord Mansfield in the case of the negro Somerset, and less emphatically by other judges at earlier dates, without any actual statute on the subject) that as soon as a slave set his foot on English soil he became free; though, if he returned to his master's country, he could be reclaimed. Up till this date the contrary impression was the usual one, though public opinion was strongly setting against the custom of keeping slaves. In 1764 there were believed to be thousands of negro slaves in London; and advertisements of 'black boys' for sale were frequent, as also rewards offered for runaways. As late as November 1771 the *Birmingham Gazette* advertised the public sale of a negro boy, sound, healthy, and of a mild disposition.

Before the idea of emancipation was contemplated the efforts of the more humane portion of the public were directed towards the abolition of the traffic in slaves, mainly under the influence of a sense of Christian duty. In 1787 a society for the suppression of the slave-trade was formed in London, numbering Thomas Clarkson and Granville Sharp among its original members. The most active parliamentary leader in the cause was William Wilberforce, and Zachary Macaulay was one of its most zealous friends. The Quakers were the only religious body who as such petitioned the House of Commons on the subject. Many not unkindly people defended slavery. Thus Boswell, who on this point opposed his master, speaking of 'so very important and necessary a branch of commercial interest,' says: 'To abolish a status which

in all ages God has sanctioned and man has continued would not only be robbery to an innumerable class of our fellow-subjects, but it would be extreme cruelty to the African savages, a portion of whom it saves from massacre and introduces to a much happier life' (*Life of Johnson*, chap. xxxv.). In 1788 an order of the crown directed that an inquiry should be made by a committee of the Privy-council into the state of the slave-trade; and an act was passed to regulate the burden of slave-ships and otherwise diminish the horrors of the middle passage. A bill introduced by Wilberforce for putting an end to the further importation of slaves was lost in 1791, but in 1792 Wilberforce, supported by Pitt, carried a motion to gradually abolish the slave-trade. And it is noteworthy that the anti-Christian French convention, influenced by the teaching of Rousseau, decreed (4th February 1794) that slavery should be abolished throughout the French colonies, and all slaves admitted to the rights of French citizens. Meanwhile, conquest of the Dutch colonies having led to a great increase in the British slave-trade, an order in council in 1805 prohibited that traffic in the conquered colonies; and in the following year an act was passed forbidding British subjects to take part in it, either for the supply of the conquered colonies or of foreign possessions. In the same year a resolution moved by Fox for a total abolition next session was carried in the Commons, and, on Lord Granville's motion, adopted in the Lords; and the following year the general abolition bill, making all slave-trade illegal after 1st January 1808, was introduced by Lord Howick (afterwards Earl Grey) in the House of Commons, was carried in both Houses, and received the royal assent on 25th March 1807. British subjects, however, continued to carry on the trade under cover of the Spanish and Portuguese flags; the slave-ships were more crowded than ever, to reduce the chances of capture, and the negroes were not unfrequently thrown overboard on a pursuit. The pecuniary penalties of the act were discovered to be inadequate to put down a traffic so lucrative as to cover all losses by capture. Brougham therefore in 1811 introduced a bill, which was carried unanimously, making the slave-trade felony, punishable with fourteen years' transportation, or from three to five years' imprisonment with hard labour. An Act of 1824 declared it piracy, and, as such, a capital crime, if committed within the Admiralty jurisdiction; and the statute of 1837, mitigating the criminal code, left it punishable with transportation for life. The Anti-slavery Society practically established the colony of Sierra Leone in 1787 as a home for destitute negroes.

The United States of America abolished the slave-trade immediately after Great Britain (1808), and the same was in the course of time done by the South American republics of Venezuela, Chili, and Buenos Ayres, by Sweden, Denmark, Holland, and, during the Hundred Days after Napoleon's return from Elba, by France. Great Britain, at the peace, exerted her influence to induce other foreign powers to adopt a similar policy; and eventually nearly all the states of Europe have passed laws or entered into treaties prohibiting the traffic. The accession of Portugal and Spain to the principle of abolition

was obtained by treaties of date 1815 and 1817; and by a convention concluded with Brazil in 1826 it was declared piratical for the subjects of that country to be engaged in the slave-trade after 1830. By the conventions with France of 1831 and 1833, to which nearly all the maritime powers of Europe have since acceded, a mutual right of search was stipulated within certain seas, for the purpose of suppressing this traffic. The provisions of these treaties were further extended in 1841 by the Quintuple Treaty between the five great European powers, subsequently ratified by all of them except France. The Ashburton treaty of 1842 with the United States provided for the maintenance by each country of a squadron on the African coast; and in 1845 a joint co-operation of the naval forces of England and France was substituted for the mutual right of search.

The limitation of the supply of negroes naturally led, among other good results, to a greater attention on the part of the masters to the condition of their slaves. But the attention of British philanthropists was next directed towards doing away with slavery altogether in the colonies. Societies were formed with this end, an agitation was set on foot, and attempts were made, for some time without success, to press the subject of emancipation on the House of Commons. At length in 1833 a ministerial proposition for emancipation was introduced by Mr Stanley (Earl of Derby), then Colonial Secretary, and an emancipation bill passed both Houses, and obtained the royal assent 28th August 1833. This act, while it gave freedom to the slaves throughout all the British colonies, at the same time awarded an indemnification to the slave-owners of £20,000,000. Slavery was to cease on 1st August 1834; but the slaves were for a certain duration of time to be apprenticed labourers to their former owners. Objections being raised to the apprenticeship, its duration was shortened, and the complete enfranchisement took place in 1838. The serious decadence of trade and commerce in the British West Indies has been commonly attributed to emancipation; but though the change in the position of the negroes unquestionably contributed to the result, it is clear that before a slave had been manumitted by law the industry of Jamaica and the other islands had already begun to fall off.

The French emancipated their negroes in 1848; as did most of the new republics of South America at the time of their establishment; while the Dutch slaves had freedom conferred on them in 1863. In Hayti slavery ceased as far back as 1791, its abolition having been one of the results of the negro insurrection of that year. In Brazil (q.v.) slavery was not abolished until 1888.

Negroes. The negro and negroid people at home are dealt with at AFRICA and ETHNOLOGY. In America the word negroes is used for all of African descent, whether of the true negro or of Bantu stock. The total number of negroes of pure or mixed blood in America has been recently estimated as somewhat above twenty millions, of whom about one-third are in the area of the United States. Their importation has been going on steadily since the early years of the 16th century,

when it was begun by the Spaniards, even the good Las Casas recommending it in the interest of the native Indians. Both Queen Elizabeth and King James I. issued patents to English slave-trading companies operating between the coast of Guinea and the American colonies. England, by the treaty of Utrecht (1713), engaged to carry out the contract of the old French Guinea Company, and to import into the New World 130,000 slaves in the course of the next thirty years, and is said to have more than made good the engagement. In the United States the traffic was open and active until the passage of the Act of 1794 prohibiting the importation of slaves into any of the federal ports. Long after this it continued to be a brisk business in the West Indies and South America. As late as 1840 there were seventy-five ships plying constantly between Brazilian ports and the African coast, bringing cargoes of 300 or 400 slaves at each trip. The principal points at which the slaves were obtained were along the coast of Guinea, especially on what was known as the Slave Coast, between the rivers Lagos and Assinie, where were the crowded marts of Waidah and Anamaboe, and again along the Angola coast, from 8° to 18° S. lat. In these two regions the traders encountered two quite different branches of the African race, and their human wares in America show that they were derived from different sources. Along the Guinea coast, whence most of the slaves brought to the United States were derived, the population belongs to the true negro type. As most of the coast tribes enriched by the traffic did not sell their own members, but obtained the slaves from the interior by capture or purchase, we do not find traces of the Faus, Ashantis, or Dahomis in the negro population of our country, but well-marked characteristics, both linguistic and anthropologic, of the interior tribes, especially of the extensive Mande or Mandingo stock. Such words as *Juba* and *Obi* are traced to this stock, and a method of counting in use among the negroes of Maryland about the beginning of the 19th century proved to be derived from the Mandingo numerals. In Brazil and other parts of South America the preponderance of importations was from the negroid stock south of the equator, whose dialects and physical traits are allied to those of the Kaffirs and Zulus of the east coast (Bantus). The slaves in all parts, however, being from mixed stocks, their descendants do not present any well-marked anthropologic peculiarities inside those of the race.

The disposition of the negro is usually pacific and cheerful. He is not easily depressed by poverty or thoughts of the future. Content that his immediate wants are provided for, he rarely prepares for a distant contingency. Eminently gregarious in his instincts, he is usually to be found in certain streets and quarters of the town exclusively occupied by members of his own race. His interest in the past is weak, and few or no reminiscences of his ancestral languages, traditions, superstitions, or usages have been retained. His religion is emotional, and exerts but a moderate influence on his morality. Frequently it is associated with superstitious beliefs and rites

known as Voodoo or Obi mysteries. It is believed by some that these are relics of the fetichistic worships of equatorial Africa, but the connection has never been demonstrated; on the contrary, the tales of the sacrifice of children, of ritual cannibalism, and of obscene ceremonies alleged to prevail in Hayti, and to a less degree among the negroes of other parts of America, have been shown by W. W. Newell to rest on very doubtful authority, and, if they occur at all, are the actions of a very few superstitious fanatics. The word *Voodoo*, or, as usually pronounced in the United States, *Hoodoo*, is a Creole form of the French *Vaudois*, and is etymologically derived from the period of the persecution of the Vaudois or Waldenses, who were represented by their opponents as sorcerers and necromancers, whence the name *Vaudois* came to be synonymous with 'witch' or 'wizard.' By a similar Creole French corruption the word *Wanga*, which among the negroes of Louisiana and Hayti means a philter or charm, and as a verb, 'to bewitch,' is, in spite of its African physiognomy, the French *Onguent*, an ointment or salve, such preparations being currently believed to possess magic powers. It is argued, therefore, that both the words and practices are of European origin. Nevertheless, it is unquestionably true that among the negroes both of the West Indies and the United States there is a widespread faith in charms, philters, and fetiches. In the latter country the employment of these means to cast an evil spell upon, or, as it is called, 'to cunjer' (to conjure), a person is familiar to every one at all acquainted with the folklore of the coloured people. The maleficent influence can be exerted by obtaining something belonging to the victim and doing some injury to it, or by securing a little of his blood, or by burying certain roots in the path where he is accustomed to walk, or by scattering brown paper before the door of his house, or in many other ways. In the West Indies an Obi bottle is often hidden in the house or goods of an enemy. It is filled with pins, rags, pebbles, small sticks, leaves of certain plants, &c. The result is often successful; for a negro who believes himself 'cunjer'd' will refuse food, and sink into the profoundest dejection, resulting occasionally in death. That a serpent or snake plays any prominent part in these Obi rites, as has often been stated, does not appear confirmed. Nor is it a prominent figure in the stories and folk-tales of the race in America. These fictitious narratives are very numerous, the negro being a tireless talker and *raconteur*. Many of them reveal a high stage of the art of story-telling, as the Georgia tales collected by J. C. Harris and Colonel C. C. Jones, and numerous others from the southern states by various writers. Many of them belong to the class of 'beast-fables,' similar to some which have been collected among the American Indians and the natives of the African continent, and such as were favourite staples of amusement in Europe during the middle ages. One of the principal figures is the rabbit (the 'brer rabbit' of the 'Uncle Remus' tales). He figures conspicuously not only in the southern United States, but in the West Indies and on the Amazon (Hartt), and as *tio conejo* ('uncle

rabbit') in the folklore of the Venezuelan negroes (Dr Ernst). This unimportant animal also plays a leading part in the mythology of various American-Indian nations, as the Algonquins and Mexicans (Aztecs); and it appears not unlikely that its prominence in negro-American folklore was a loan from this source. Along with story-telling, singing and music are favourite diversions of the coloured population. This tendency is a direct inheritance from their African ancestry, as throughout that continent the natives are passionately fond of these diversions. In Central America the negroes still employ the *marimba*, a native African instrument with wooden keys placed over jars or gourds, the keys being struck with a stick. In the United States the violin, the fife, and the guitar are used, but the favourite is the 'banjo,' an instrument of African derivation, modified from the guitars with grass strings still in use on the Guinea coast. With these simple means they produce music of pleasant though not artistic character. In individual instances (as Blind Tom, born in Georgia in 1849) members of the race have attained remarkable skill on the piano and organ, rendering the most difficult compositions with spirit. No negro composer, however, has attained celebrity. Their songs are numerous, many of them of a religious character, others turning on the incidents of daily life. They are generally defective in prosody and without merit, being often little more than words strung together to carry an air.

The negro is ambitious for education, but unwilling to make the necessary mental effort to obtain it. In the public schools of the United States, where they are on the same footing as the white children, their progress is about equal up to the age of puberty. But after that important physical change there supervenes a visible ascendancy of the appetites and emotions over the intellect, and an increasing indisposition to mental labour.

The consequence is that in the higher education they fall notably behind the whites, and it is a rare exception for one of them to undertake the studies requisite for a profession; and when one does, he is content with what is barely sufficient for its remunerative practice. The social position of the members of the race in some parts of South America is little different from that of the whites. This is also theoretically the case in the United States since the civil war; but the natural sense of inequality between the two races is making itself felt in the latter country, and they are probably now farther asunder in sympathies than they were at the close of the war, both in the northern and southern states. Many thoughtful and learned men see in the increasing coloured population a standing menace to the institutions and culture of their country, and the project has been seriously urged to deport the whole negro stock back to Africa, and prevent others from coming to the country.

THE CENTURY MAGAZINE — APRIL, 1890

THE SLAVE TRADE IN THE CONGO BASIN

BY ONE OF STANLEY'S PIONEER OFFICERS.

ILLUSTRATED AFTER SKETCHES FROM LIFE BY THE AUTHOR.

WITH STANLEY.



CANE HANDCUFF.

THE heart of Africa is being rapidly depopulated in consequence of the enormous death-roll caused by the barbarous slave-trade. It is not merely the bondage which slavery implies that should appeal to the sympathies of the civilized world; it is the bloodshed, cruelty, and misery which it involves.

During my residence in Central Africa I was repeatedly traveling about in the villages along the Congo River and its almost unknown affluents, and in every new village I was

confronted by fresh evidences of the horrible nature of this evil. I did not seek to witness the sufferings attendant upon this traffic in humanity, but cruelties of all kinds are so general that the mere passing visits which I paid brought me in constant contact with them.

It is not alone by the Arabs that slave-raiding is carried on throughout Central Africa. With respect to slavery in the Congo Free State, the western limit of the slave-raiding operations of the Arabs is the Aruwhimi River, just below Stanley Falls, but intertribal slavery exists from this point throughout the State to the Atlantic Ocean. During my six years' residence on the Congo River I saw but little of the Arabs, and therefore in this article I am detailing only my experiences bearing upon the subject of slavery among the natives

themselves.

I first went to the Congo in 1883, and traveled without delay into the interior. Arriving at Stanley Pool, I received orders from my chief, Mr. Henry M. Stanley, to accompany him up river on his little boat the *En Avant*. Stanley at that time was engaged in establishing a few posts at important and strategic points along the upper river. Lukolela, eight hundred miles in the interior, was one decided upon, and I had the honor of being selected by him as chief of this post. As no white man had ever lived there before, I had a great deal of work in establishing myself. The position selected for our settlement was a dense forest, and until now it had been more familiar with the trumpeting of elephants and the cry of the leopard than with human beings. At first the natives rather objected to my remaining at all, and stated their objections to Stanley. Said they: "We have promised to allow you to put a white man here, but we have been talking the matter over, and we have concluded it would be better to put your white man somewhere else. We, the assembled chiefs, have held a council, and have come to the conclusion that it is not desirable to have such a terrible creature in the district." Stanley said: "Why, what is there in him that you object to? You have never seen him." (I had not yet landed, being at that time very sick and unable to leave the boat.) They said, "No, we have not seen him, but we have heard about him." Stanley then said, "What have you heard about him?" They replied: "He is half a lion, and half a buffalo; has one eye in the middle of his forehead, and is armed with sharp, jagged teeth; and is continually slaughtering and devouring human beings. Is this so?" Stanley answered them, "I did not know that he was such a terrible creature; but I will call him, and let you judge for yourselves." Upon my appearing this illusion was immediately dispelled, as, after suffering several days from an acute sickness, I really did not look very formidable or bloodthirsty.

Here I lived for twenty months, the only white man, so that I had every opportunity of studying native character and customs.



NATIVE LIFE.

IN order to place before the reader a picture of savage life untouched by civilization, I could hardly do better than lightly sketch a typical village at Lukolela as I have intimately known it. The whole district contains about three thousand people, the land occupied by them extending along the bank for two miles, the villages being dotted through this distance in clusters of fifty or sixty houses. The houses are built on each side of one long street or in open squares. They are roofed with either palm leaves or grass, the walls being composed of split bamboo. Some of these dwellings contain two or three compartments, with only one entrance; while others are long structures, divided up into ten or twelve rooms, each with its own entrance from the outside. At the back of these dwellings are large plantations of banana trees; while above them tower the stately palm trees, covering street and hut with their friendly shade.

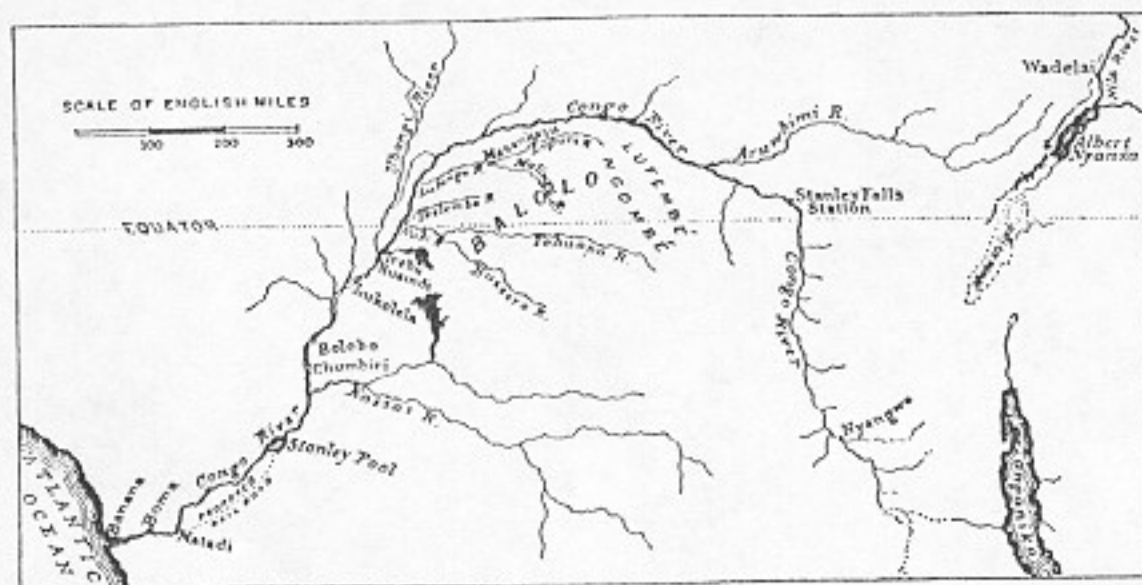
It is in the cool of the early morning that the greater part of the business of the village is transacted. Most of the women repair, soon after six, to their plantations, where they work until noon, a few of them remaining in the village to attend to culinary and other domestic matters. Large earthen pots, containing fish, banana, or manioc, are boiling over wood fires, around which cluster the young boys and girls and the few old men and women enjoying the heat until the warm rays of the morning sun appear. Meanwhile the fishermen gather up their traps, arm themselves, and paddle off to their fishing-grounds; the hunters take their spears or bows and arrows and start off to pick up tracks of their game; the village blacksmith starts his fire; the adze of the carpenter is heard busily at work; fishing and game nets are unrolled and damages examined; and the medicine man is busy gesticulating with his charms. As the sun rises the scene becomes more and more animated; the warmth of the fire is discarded, and every department of industry becomes full of life—the whole scene rendered cheerful by the happy faces and merry laughter of the little ones as they scamper here and there engaged in their games.

At noon the overpowering heat of the tropical sun compels a cessation of work, and a lazy quietude prevails everywhere. Then all the shady nooks of the village are filled with groups who either sleep, engage in conversation, or pass their time in hair-dressing or in attending to some other toilet matter which native etiquette demands, such as shaving off eyebrows or pulling out eyelashes — an operation which

is also extended to all hairs on the face except those on the chin, which are plaited in the form of a rat's tail. The closer the finger nails are cut, the more fashionable is it thought. At the finger ends the nails are cut down to the quick, and any one posing as either beau or belle always has some of the finger and toe nails pared entirely off.

The midday meal is now eaten, the whole village assuming an air of calmness, broken only by the occasional bursts of boisterous mirth from groups engaged in discussing the merits of the native wine.

All mankind have the same weakness in requiring at times drink stronger than water. Nature has provided the African with the juice of the palm tree, a most palatable beverage, resembling when fresh a very strong lemon soda, but intoxicating in its effects. It is obtained in the following way: the villagers in charge of this particular industry climb the tree, trim away some of the leaves, and then bore three or four holes, about half an inch in diameter, at the base of the frond, to the heart of the tree. From each of these holes will flow each day about half a pint of juice, a small gourd being first placed to receive it. The contents of

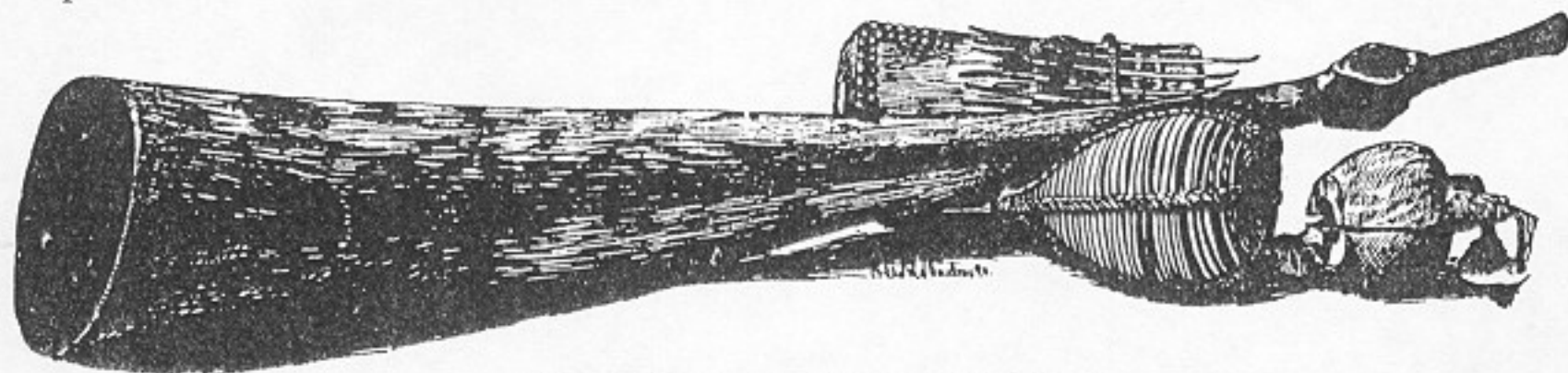


THE CONGO BASIN.

these gourds are collected every morning. This beverage is called by the natives *malafu*, and is well known to all European travelers as palm wine.

Between three and four o'clock the village again resumes its air of activity, which is kept up until sundown. In this region, being close to the equator, the sun sets at six o'clock. All tools are put away, and work is suspended. The fires are again lighted, mats are brought out and spread about, and the principal meal of the day is eaten; after which the natives gather around the fire again and talk over the events of the day and the plans for the future. The young people repair to the open places and indulge in their native dances until midnight.

This dancing at night is a sight to be remembered. The performers arrange themselves in circles and dance in time to the beating of the drums, which is their only accompaniment, and occasionally break out into native songs. The surrounding tropical scenery stands outlined in bold relief, the nearer trees occasionally catching the lurid light of the fires, which also strikes on the gleaming bodies of the dancers, making a violent contrast of light and shade, the whole scene being



WAR HORN AND OTHER MUSICAL INSTRUMENTS.

rendered impressive by the wild but harmonious music.

At midnight, when all the villagers have retired to their huts, stillness reigns, broken only at times by the weird call of a strange bird, the cry of a prowling leopard or some other wild animal, and the varied sounds of tropical insects.

THE EFFECT OF SLAVERY.

THIS is a fair picture of the life carried on from day to day in a hundred Congo villages, and but for the existence of slavery it would continue undisturbed from one year's end to another. It is the presence of the slave in the village that brutalizes the otherwise harmless and peaceful community. It is the baneful influence that gives one man the power of life and death over the wretch he has purchased that impels the savage instinct to spill in exe-

cutions and ceremonies the life-blood of the man, woman, or child he has obtained—perhaps in exchange for a few brass rods or two or three yards of Manchester cloth. Here at Lukolela, for instance, I had hardly settled down in my encampment when I was introduced to one of those horrible scenes of bloodshed which take place frequently in all the villages along the Congo, and which will be enacted so long as the life of a slave is counted as naught, and the spilling of his blood of as little account as that of a goat or a fowl.

In this particular instance the mother of a chief having

died, it was decided, as usual, to celebrate the event with an execution. At the earliest streak of dawn the slow, measured beat of a big drum announces to all what is to take place, and warns the poor slave who is to be the victim that his end is nigh. It is very evident that something unusual is about to happen, and that the day is to be given up to some ceremony. The natives gather in groups and begin studiously to arrange their toilets, don their gayest loin-cloths, and ornament their legs and arms with bright metal bangles, all the time indulging in wild gesticulations and savage laughter as they discuss the coming event. Having taken a hasty meal, they produce from their houses all available musical instruments. The drums are wildly beaten as

groups of men, women, and children form themselves in circles and excitedly perform dances, consisting of violent contortions of the limbs, accompanied with savage singing and with repeated blasts of



CONGO KNIVES.

the war horns, each dancer trying to out-do his fellow in violence of movement and strength of lung.

About noon, from sheer exhaustion, combined with the heat of the sun, they are compelled to cease; when large jars of palm wine are produced, and a general bout of intoxication begins, increasing their excitement and showing up their savage nature in striking colors. The poor slave, who all this time has been lying in the corner of some hut, shackled hand and foot and closely watched, suffering the agony and suspense which this wild tumult suggests to him, is now carried to some prominent part of the village, there to be surrounded and to receive the jeers and scoffs of the drunken mob of savages. The executioner's assistants, having selected a suitable place for the ceremony, procure a block of wood about a foot square. The slave is then placed on this, in a sitting posture; his legs are stretched out straight in front of him; the body is strapped to a stake reaching up the back to the shoulders. On each side stakes are placed under the armpits as props, to which the arms are firmly bound; other lashings are made to posts driven into the ground near the ankles and knees.

A pole is now planted about ten feet in front of the victim, from the top of which is suspended, by a number of strings, a bamboo ring. The pole is bent over like a fishing-rod, and the ring fastened round the slave's neck, which is kept rigid and stiff by the tension. During this preparation the dances are resumed, now rendered savage and brutal in the extreme by the drunken condition of the people. One group of dancers surround the victim and indulge in drunken mimicry of the contortions of face which the pain caused by this cruel torture forces him to show. But he has no sympathy to expect from this merciless horde.

Presently in the distance approaches a company of two lines of young people, each holding a stem of the palm tree, so that an arch is formed between them, under which the executioner is escorted. The whole procession moves with a slow but dancing gait. Upon arriving near the doomed slave all dancing, singing, and drumming cease, and the



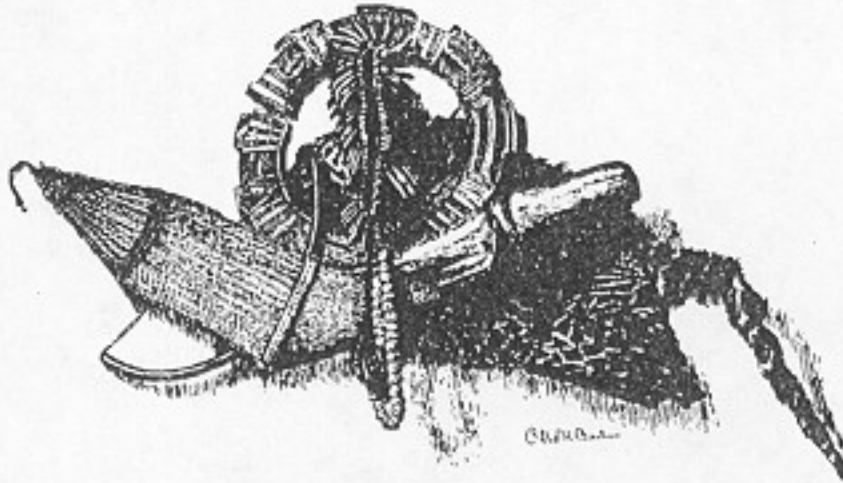
LOIN-CLOTH AND EXECUTIONER'S KNIFE AND HAT.

drunken mob take their places to witness the last act of the drama.

An unearthly silence succeeds. The executioner wears a cap composed of black cocks' feathers; his face and neck are blackened with charcoal, except the eyes, the lids of which are painted with white chalk. The hands and arms to the elbow, and feet and legs to the knee, are also blackened. His legs are adorned profusely with broad metal anklets, and around his waist are strung wild-cat skins. As he performs a wild dance around his victim, every now and then making a feint with his knife, a murmur of admiration arises from the assembled crowd. He then approaches and makes a thin chalk mark on the neck of the fated

man. After two or three passes of his knife, to get the right swing, he delivers the fatal blow, and with one stroke of his keen-edged weapon severs the head from the body.

The sight of blood brings to a climax the frenzy of the natives: some of them savagely puncture the quivering trunk with their spears, others hack at it with their knives, while the remainder engage in a ghastly struggle for the



NATIVE WEARING APPAREL.

possession of the head, which has been jerked into the air by the released tension of the sapling. As each man obtains the trophy, and is pursued by the drunken rabble, the hideous tumult becomes deafening; they smear one another's faces with blood, and fights always spring up as a result, when knives and spears are freely used. The reason for their anxiety to possess the head is this: the man who can retain that head against all comers until sundown will receive a present for his bravery from the head man of the village. It is by such means that they test the brave of the village, and they will say with admiration, speaking of a local hero, "He is a brave man; he has retained two heads until sundown."

When the taste for blood has been to a certain extent satisfied, they again resume their singing and dancing while another victim is prepared, when the same ghastly exhibition is repeated. Sometimes as many as twenty slaves will be slaughtered in one day. The dancing and general drunken uproar is continued until midnight, when once more absolute silence ensues, in utter contrast to the hideous tumult of the day.

I had frequently heard the natives boast of the skill of their executioners, but I doubted their ability to decapitate a man with one blow of the soft metal knives they use. I imagined

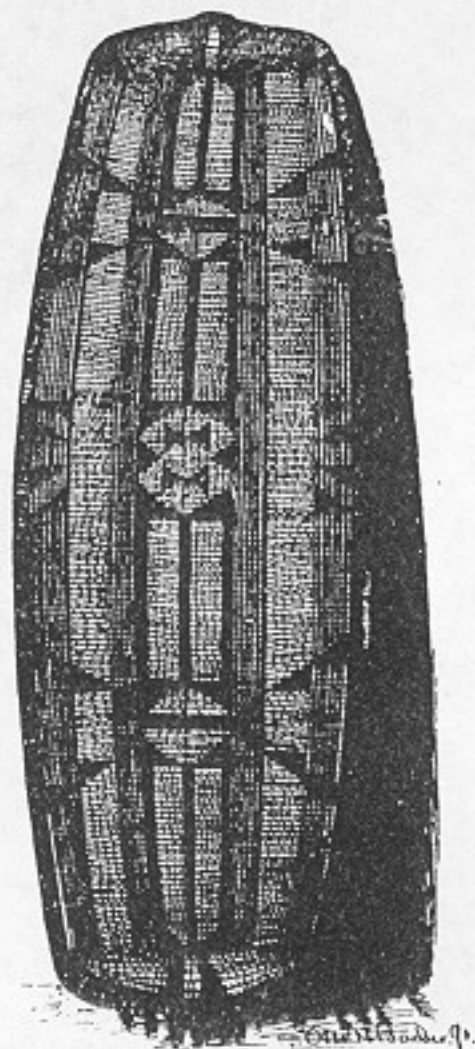
they would be compelled to hack the head from the body. When I witnessed this sickening spectacle I was alone, unarmed, and absolutely powerless to interfere. But the mute agony of this poor black martyr, who was to die for no crime, but simply because he was a slave,—whose every piteous movement was mocked by frenzied savages, and whose very death throes gave the signal for the unrestrained outburst of a hideous carnival of drunken savagery,—appealed so strongly to my sense of duty that I decided upon preventing by force any repetition of this scene. I made my resolution known to an assembly of the principal chiefs, and although several attempts were made, no actual executions took place during the remainder of my stay in this district.

A FEW words are necessary to define the position of the village chiefs as the most important factors in African savage life; especially as in one way or another they are intimately connected with the worst features of the slave system, and are responsible for nearly all the atrocities practiced on the slave.

The so-called chiefs are the head men of a village, and they rank according to the number of their warriors. The title of chieftain is not hereditary, but is gained by one member of a tribe proving his superiority to his fellows. The most influential chief in a village has necessarily the greatest number of fighting men, and these are principally slaves, as the allegiance of a free man can never be depended upon. A chief's idea of wealth is—slaves. Any kinds of money he may have he will convert into slaves upon the first opportunity. Polygamy is general throughout Central Africa, and a chief buys as many female slaves as he can afford, and will also marry free women—which is, after all, only another form of purchase.

MODES OF TORTURE.

ALL tribes I have known have an idea of immortality. They believe that death leads but to another life, to be continued under the same conditions as the life they are now leading; and a chief thinks that if when he enters into this new existence he is accompanied by a sufficient following of slaves he will be entitled to the same rank in the



NGOMBÉ SHIELD.



LOLO MAN.

next world as he holds in this. From this belief emanates one of their most barbarous customs — the ceremony of human sacrifices upon the death of any one of importance. Upon the decease of a chief, a certain number of his slaves are selected to be sacrificed, that their spirits may accompany him to the next world. Should this chief possess thirty men and twenty women, seven or eight of the former and six or seven

of the latter will suffer death. The men are decapitated, and the women are strangled. When a woman is to be sacrificed she is adorned with bright metal bangles, her toilet is carefully attended to, her hair is neatly plaited, and bright-colored cloths are wrapped around her. Her hands are then pinioned behind, and her neck is passed through a noose of cord; the long end of the cord is led over the branch of the

nearest tree, and is drawn taut at a given signal; and while the body is swinging in mid-air its convulsive movements are imitated with savage gusto by the spectators. It often happens that a little child also becomes a victim to this horrible ceremony, by being placed in the grave alive, as a pillow for the dead chief. These executions are still perpetrated in all the villages of the Upper Congo.

But the life of the slave is not only forfeited at the death of the chief of the tribe in which fate has cast his lot. Let us suppose that the tribe he is owned by has been maintaining an internecine warfare with another tribe in the same district. For some reason it is deemed politic by the chief to bring the feud to an end, and a meeting is arranged with his rival. At the conclusion of the interview, in order that the treaty of peace may be solemnly ratified, blood must be spilled.

A slave is therefore selected, and the mode of torture preceding his death will vary in different districts. In the Ubangi River district the slave is suspended head downwards from the branch of a tree, and there left to die. But even more horrible is the fate of such a one at Chumbiri, Bolobo, or the large villages around Irebu, where the expiatory victim is actually buried alive with only the head left above the ground. All his bones have first been crushed or broken, and in speechless agony he waits for death. He is usually thus buried at the junction of two highways, or by the side of some well-trodden pathway leading from the village; and of all the numerous villagers who pass to and fro, not one, even if he felt a momentary pang of pity, would dare either to alleviate or to end his misery, for this is forbidden under the severest penalties.

HOW THE NATIVES ARE ENSLAVED.

THE varying fortunes of tribal warfare furnish the markets with slaves whose cicatrization marks show them to be members of widely differing families and distant villages. But there are some tribes, and these the most inoffensive and the most peaceful, whose weakness places them at all times at the mercy of their more powerful neighbors. Without exception the most persecuted race in the dominions of the Congo Free State are the Balolo tribes, inhabiting the country

through which the Malinga, Lupuri, Lulungu, and Ikelemba rivers flow. I may here mention that the prefix "Ba" in the language of these people implies the plural; for instance, Lolo would mean one Lolo—Ba-lolo signifying Lolo people. These people are naturally mild and inoffensive. Their small, unprotected villages are constantly attacked by the powerful roving tribes of the Lufembé and Ngombé. These two tribes are voracious cannibals. They surround the Lolo villages at night, and at the first signs of dawn pounce down upon the unsuspecting Balolo, killing all the men who resist and catching all the rest. They then select the stronger portion of their captives, and shackle them hand and foot to prevent their escape. The remainder they kill, distributing the flesh among themselves.



LOLO WOMAN.

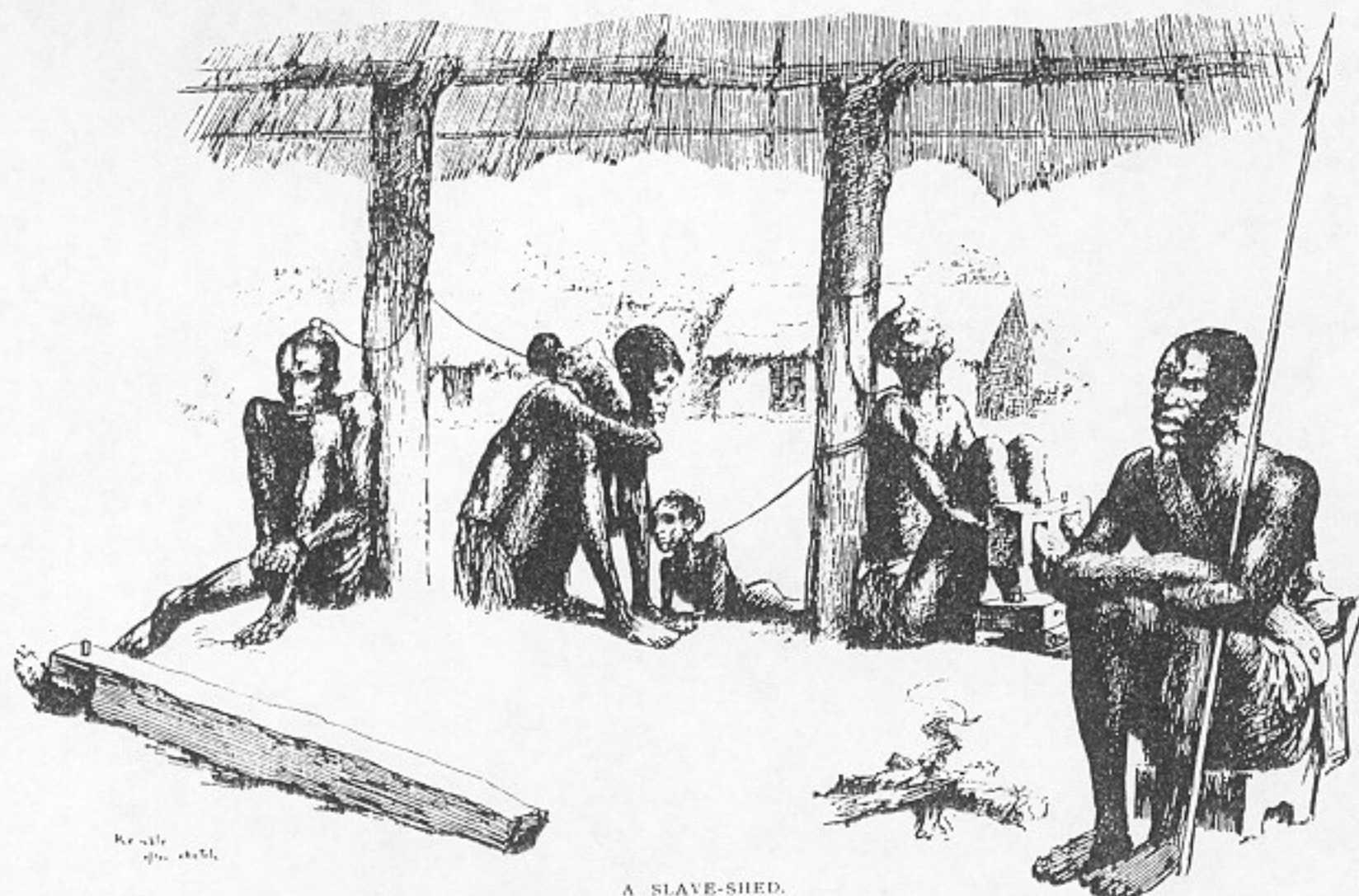


A CAPTIVE.

As a rule, after such a raid they form a small encampment; they light their fires, seize all the bananas in the village, and gorge upon the human flesh. They then march over to one of the numerous slave-markets on the river, where they exchange the captives with the slave-traders of the Lulungu River for beads, cloth, brass wire, and other trinkets. The slave-traders pack the slaves into their canoes and take them down to the villages on the Lulungu River where the more important markets are held. Masankusu, situated at the junction of the Lupuri and Malinga tributaries, is by far the most important slave-trading center. The people of Masankusu buy their slaves from the Lufembé and Ngombé raiders, and sell them to the Lulungu natives and traders from down river. The slaves are exhibited for sale at Masankusu in long sheds, or rather under simple grass roofs supported on bare poles. It is heartrending to see the inmates of one of these slave-sheds. They are huddled together like so many animals.

IN THE SLAVE-SHED.

THE accompanying pictures, from sketches which I took at Masankusu, will give some idea of the suffering which is endured by captives in numberless slave-markets. They are hobbled with roughly hewn logs which chafe their limbs to open sores; sometimes a whole tree presses its weight on their bodies while their necks are penned into the natural prong formed by its branching limbs. Others sit from day to day with their legs and arms maintained in a fixed position by rudely constructed stocks, and each slave is secured to the roof-posts by a cord knotted to a cane ring which either encircles his neck or is intertwined with his woolly hair. Many die of pure starvation, as the owners give them barely enough food to exist upon, and even that they grudge them. These hungry creatures form indeed a truly pitiable sight. After suffering this captivity for a short time they become mere skeletons. All ages, of both sexes, are to be seen: mothers with their babes; young men and women; boys and girls; and even babies who cannot yet walk, and whose



mothers have died of starvation, or perhaps been killed by the Lufembé. One seldom sees either old men or old women; they are all killed in the raids: their marketable value being very small, no trouble is taken with them.

Witnessing groups of these poor, helpless wretches, with their emaciated forms and sunken eyes, their faces a very picture of sadness, it is not difficult to perceive the intense grief that they are inwardly suffering; but they know too well it is of no use to appeal for sympathy to their merciless masters, who have been accustomed from childhood to witness acts of cruelty and brutality, so that to satisfy their insatiable greed they will commit themselves, or permit to be committed, any atrocity, however great. Even the pitiable sight of one of these slave-sheds does not half represent the misery caused by this traffic—homes broken up, mothers separated from their babies, husbands from wives, and brothers from sisters. When last at Masankusu I saw a slave woman who had with her one child, whose starved little body she was clutching to her shrunken breast. I was attracted by her sad face, which betokened great suffering. I asked her the cause of it, and she told me in a low, sobbing voice the following tale:

"I was living with my husband and three

children in an inland village, a few miles from here. My husband was a hunter. Ten days ago the Lufembe attacked our settlement; my husband defended himself, but was overpowered and speared to death with several of the other villagers. I was brought here with my three children, two of whom have already been purchased by the traders. I shall never see them any more. Perhaps they will kill them on the death of some chief, or perhaps kill them for food. My remaining child, you see, is ill, dying from starvation; they give us nothing to eat. I expect even this one will be taken from me to-day, as the chief, fearing lest it should die and become a total loss, has offered it for a very small price. As for myself," said she, "they will sell me to one of the neighboring tribes, to toil in the plantations, and when I become old and unfit for work I shall be killed."

There were certainly five hundred slaves exposed for sale in this one village alone. Large canoes were constantly arriving from down river, with merchandise of all kinds with which they purchased these slaves. A large trade is carried on between the Ubangi and Lulungu rivers. The people inhabiting the mouth of the Ubangi buy the Balolo slaves at Masankusu and the other markets. They then take them

up the Ubangi River and exchange them with the natives there for ivory. These natives buy their slaves solely for food. Having purchased slaves they feed them on ripe bananas, fish, and oil, and when they get them into good condition they kill them. Hundreds of the Balolo slaves are taken into the river and disposed of in this way each month. A great many other slaves are sold to the large villages on the Congo, to supply victims for the execution ceremonies.

Much life is lost in the capturing of slaves,



A LUFEMBE SLAVE-HUNTER.

and during their captivity many succumb to starvation. Of the remainder, numbers are sold to become victims to cannibalism and human sacrifice ceremonies. There are few indeed who are allowed to live and prosper.

CANNIBALISM.

CANNIBALISM exists among all the peoples on the Upper Congo east of 16° E. longitude, and is prevalent to an even greater extent among the people inhabiting the banks of the numerous affluents. During a two-months' voyage on the Ubangi River I was constantly brought into contact with cannibalism. The natives there pride themselves upon the number of skulls they possess, denoting the number of victims they have been able to obtain. I saw one native hut, around which was built a raised platform of clay a foot wide, on which were placed rows of human skulls, forming a ghastly picture, but one of which the chief was very proud, as he signified by the admiring way he drew my attention to the sight. Bunches of twenty and thirty skulls were hung about in prominent positions in the village. I asked one young chief, who was certainly not more than twenty-five years old, how many men he had eaten in his village, and he answered me thirty. He was greatly astonished at the horror I expressed at his answer. In one village again, as I had bought a tusk of ivory, the natives thought perhaps I might buy skulls, and several armfuls were brought down to my boat within a few minutes.

I found trading somewhat difficult on this river, as the standard of value on the Ubangi was human life—human flesh. I have been asked on several occasions to barter a man for a tusk of ivory, and I remember that at one village the natives urged me to leave one of my boat's crew in exchange for a goat. "Meat for meat," they said. I was repeatedly invited, too, to help them fight some of the neighboring tribes. They said, "You can take the ivory, and we will take the meat"—meaning, of course, the human beings who might be killed in the fight. The more unfriendly of them would frequently threaten that they would eat us, and I have no doubt they would have done so had we not been strong enough to take care of ourselves.

During my first visit to the upper waters of the Malinga River cannibalism was brought

to my notice in a ghastly manner. One night I heard a woman's piercing shriek, followed by a stifled, gurgling moan; then boisterous laughter, when all again became silent. In the morning I was horrified to see a native offering for sale to my men a piece of human flesh, the skin of which bore the tribal tattoo mark of the Balolo. I afterwards learned that the cry we had heard at night was from a female slave whose throat had been cut. I was absent from this village of Malinga for ten days. On my return I inquired if any further bloodshed had taken place, and was informed that five other women had been killed.

While in the Ruki River at the beginning of this year, I was furnished with another proof of the horrible fate of the slaves. At Esengé, a village near which I stopped to cut wood for my steamer, I heard ominous beating of drums and outbreaks of excited mirth. I was informed by one of the natives from the village that an execution was taking place. To my inquiry whether they were in the habit of eating human flesh, he replied, "We eat the body entirely." I further asked what they did with the head. "Eat it," he replied; "but first we put it in the fire to singe the hair off."

There is a small river situated between the Ruki and the Lulungu, called the Ikelemba. At its mouth it is not more than 140 yards wide. Its waters are navigable for 140 miles, and it flows through the land of the Balolo. In proportion to its size it supplies more slaves than any other river. By looking on the map it will be seen that the Ikelemba, Ruki, and Lulungu run parallel to one another. The large slave-raiding tribes inhabit the land between these rivers, and bring their slaves to the nearest market, whether on the Ikelemba, Ruki, or Lulungu.

LOCAL SLAVE-MARKETS.

THERE are clearings at intervals all along the banks of the Ikelemba, where on certain days are held small local markets for the exchange of slaves. As one travels up stream small settlements are passed more and more frequently, and fifty miles from the mouth all the country on the left side of the river is thickly populated. It is noticeable that the villages are all on the left side of the river, the opposite side being infested by marauding and roving tribes who would raid any settlement made on their banks. All the slaves

from this river are Balolo, a tribe which is easily recognizable by the exaggerated tattoo marked on the forehead, side of the temples, and chin.

During my ten-days' visit to this river I met dozens of canoes belonging to the country at the mouth of the Ruki River and the Bakuté district, whose owners had come up and bought slaves, and were returning with their purchases. When traveling from place to place on the river the slaves are, for convenience, relieved of the weight of the heavy shackles. The traders always carry, hanging from the sheaths of their knives, light handcuffs, formed of cord and cane.

The slave when purchased is packed on the floor of the canoe in a crouching posture with his hands bound in front of him by means of these handcuffs. During the voyage he is carefully guarded by the crew of standing paddlers; and when the canoe is tied to the bank at night the further precaution is taken of changing the position in which the hands are bound and pinioning them behind his back, to prevent him from endeavoring to free himself by gnawing through the strands. To make any attempt at escape quite impossible, his wrist is bound to that of one of his sleeping masters, who would be aroused at his slightest movement.

In one canoe which I noticed particularly there were five traders, and their freight of miserable humanity consisted of thirteen emaciated Balolo slaves, men, women, and little children, all showing unmistakably by their sunken eyes and meager bodies the starvation and the cruelty to which they had been subjected. These slaves are taken down to the large villages at the mouth of the Ruki, where they are sold in exchange for ivory to the people in the Ruki or the Ubangi district, who buy them to supply some cannibal orgy. A few, however, are sold about the district, the men to be used as warriors, and the women as wives; but compared with the numbers who suffer from the persecution of the slave-raiders, few indeed ever live to attain a secure position of even the humblest kind in a village.

The wretched state of these Balolo has always saddened me, as intellectually they are a grade higher than the tribes surrounding them; and it is really owing to the gentler fiber

of their natures, and their peaceful, trusting disposition, that they easily fall a prey to the degraded and savage hordes in their district. They have artistic taste and mechanical ingenuity, and make exquisitely woven shields and curiously shaped and decorated spears and knives. They are exceedingly intelligent, faithful, and, when properly officered, brave.

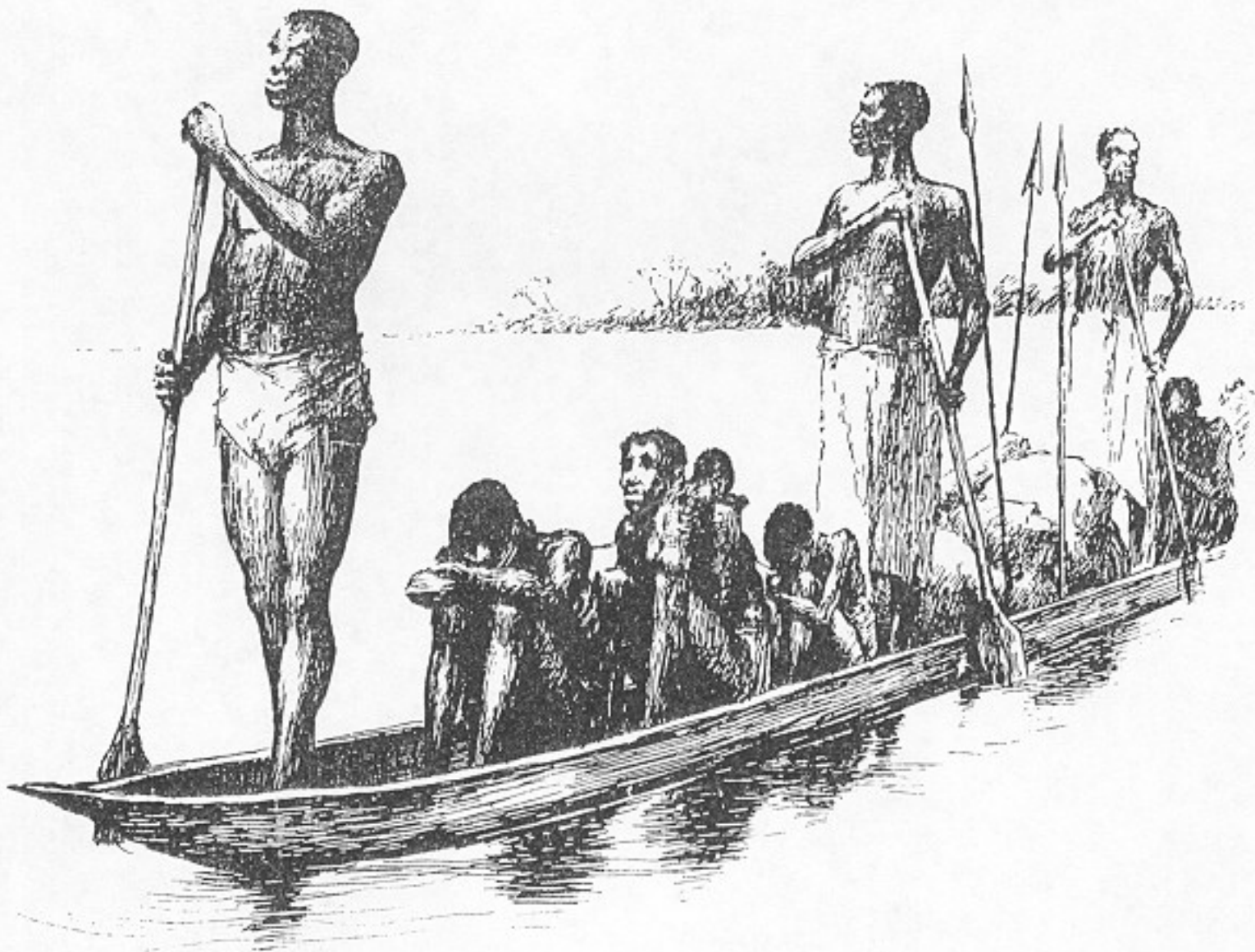
IN THE FAR INTERIOR.

FOR many months I traveled on the Upper Congo and its affluents and had on several occasions to defend myself against the hostility of the natives. My crew consisted of fifteen men, the greater part of whom were Balolo, and I was never deceived by them.

When first I engaged them they came into my hands in the rough. They were savages, some of them cannibals; but they are of a very malleable nature, and with a policy of firmness and fair play I was able to convert them into devoted and faithful servants.

As evidence of what can be done by gaining the confidence of the natives, through a policy of firmness and fairness, I think I may safely quote my experience at the Equator Station. I remained there for nearly a year,

with only one Zanzibari soldier; all the rest of my people were natives I had engaged from the neighboring villages. I was surrounded on all sides by powerful people, who, had they wished, could easily have



A SLAVER'S CANOE.

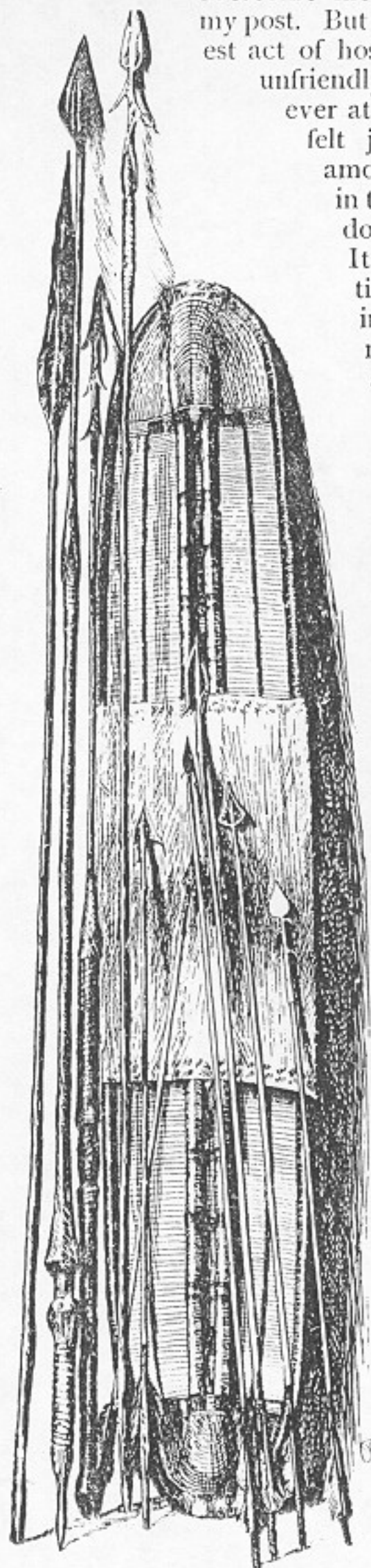
overcome me and pillaged my post. But not the slightest act of hostility or of an unfriendly nature was ever attempted, and I felt just as secure among them as I do in the city of London or New York. It is true the natives had nothing to gain by molesting me, and they were intelligent enough to perceive that fact. In reality, my presence was, to a great extent, beneficial to their interests. I had cloth, beads, looking-glasses, spoons, cups, and trinkets, and these I exchanged with them; every now and then I would organize a little hunt after elephants or hippopotami; and as my part in the consumption of either of these animals was a very small one, most of the meat I gave away to the natives.

My life during my stay at the Equator Station

was a pleasant one. The people were of a happy and gay disposition; all were friendly and talkative. They would sit for hours and listen most attentively to my tales of Europe, and their intelligent questions proved them to be possessed of keen understanding. There is no more attentive audience in the whole world than a group of African savages, if you can speak their language and make yourself understood. When I was tired of talking to them, I would ask them questions concerning their manners, customs, and traditions. As I was much impressed by their cruelty, I always made a point of expressing my abhorrence of it, and have even told them that one day I should strike a blow for the slave. My audience on such occasions consisted principally of slaves, and these poor wretches were always much gratified to hear my friendly opinions towards themselves. My arguments, I could see, often appealed strongly to the chiefs themselves, as I asked them: "Why do you kill these people? Do you think they have no feeling because they are slaves? How would you like to see your own child torn away from you and sold into slavery, to satisfy the cravings of cannibalism, or to be executed?" They even said, some of them, at the time, that they would not hold any more executions. These executions did take place, but in a secret manner, and all news of them was kept from my ears until some time afterwards, when I learned of them from my own men. But I would have been unable to prevent the carrying out of such a ceremony with the force I had at my disposal in a single Zanzibari soldier!

SOME BARBAROUS CUSTOMS.

I REMEMBER one execution which took place, the details of which I learned afterwards. It was to celebrate the death of a chief who had been drowned while on a trading expedition. As soon as the news of his death was brought to the village, several of his slaves were tied hand and foot and lashed down into the bottom of a canoe. The canoe was then towed out to the middle of the river at night; holes were bored in it, and it was allowed to sink with its human freight. When we are able to prohibit the terrible loss of life which the children of to-day are compelled constantly to witness, more humane feelings may develop themselves, and surrounded by healthy in-



SPEARS, SHIELD, AND ARROWS.

fluences they will, unspoiled by at least open exhibitions of cruelty, grow into a far nobler generation.

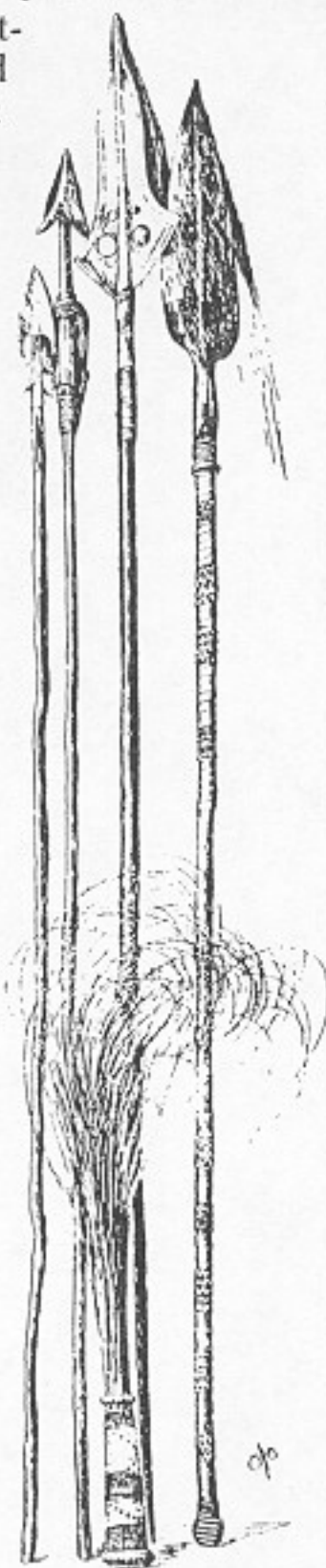
Natives suffering at the hands of the slave traders have repeatedly asked me to help them. At Malinga, where human flesh was offered me for sale, the assembled chiefs voted me several tusks of ivory if I would live among them and defend them against the Lufembé, and enable them to resist the persecutions they were exposed to from the neighboring tribes, who were continually making raids into their districts, capturing their people. They said: "We are being starved to death. We can make no plantations, because when our women visit them they are caught, killed, and eaten by the crafty Lufembé, who are constantly prowling around and taking away any stragglers they may see." One old chief, Isekiaka, told me that already from time to time twelve of his women had been stolen from him, and several of his children. Indeed, so wretched is the condition of the people on the upper reaches of the Malinga that numbers of them have been driven by the Lufembé from their plantations on the mainland, and are actually compelled to live on the river in miserable huts, the floors of which are supported on piles. From these dwellings they suspend their nets, and as the river is full of fish, they subsist almost entirely on the produce of their hauls. This has given rise to a curious state of things; for, as the Lufembé grow only manioc, and have more roots than are sufficient for the tribe, they are only too glad to exchange these for fish caught by their victims. And so when a market is held an armed truce is declared, and Lufembé and Malinga mingle together and barter, with their products held in one hand and a drawn knife ready in the other.

It can be readily imagined that the incessant persecution which the natives are suffering renders them cruel and remorseless. Throughout the regions of the Malinga they become so brutalized by hunger that they eat their own dead, and the appearance of one of their villages always denotes abject misery and starvation. I have repeatedly seen young children eating the root of the banana tree, vainly endeavoring to obtain some kind of nourishment from its succulence. That they are able to exist at all is a mystery. Every living object they are able to obtain is accepted

as food; different kinds of flies, caterpillars, and crickets are all eaten by these people.

When one has lived for some time in Central Africa, one comes to understand the little impression that acts of the most atrocious and wanton cruelty make on the savage mind. Surrounded from childhood by scenes of bloodshed and torture, their holidays and great ceremonies marked by massacres of slaves, the mildest and most sensitive nature becomes brutalized and callous; and if this is so with the free, what must be the effect upon the slave, torn when a child from its mother, perhaps at the age of two years, and even in its infancy compelled to suffer privation. If indeed this child runs the gauntlet of cannibalism and execution ceremonies, it can hardly be expected that he will sympathize with any suffering.

The people on the lower part of the Upper Congo seldom practice slave-raiding. It is only when we come to the Bakuté district that we are brought much in contact with it. The large villages around Stanley Pool,—Chumbiri, Bolobo, Lukolela, Butunu, Ngombé, Busindi, Irebu,—Lake Mantumba, and the Ubangi River all rely principally upon the Balolo tribes for their slaves. All these villages except Stanley Pool are daily making human sacrifices, either in connection with the death of some chief or for some other ceremonial reason. Any kind of com-



SPEARS AND "DEVIL DODGER."

merce transacted in this part of Africa only increases the bloodshed, because the native's ambition is to get as many slaves as possible around him; and when he sells a tusk of ivory or any other article he devotes nearly all of the cloth, brass wire, and beads which he obtains in exchange to the purchase of fresh slaves. So that he is surrounded by numerous women and warriors during his lifetime, and has his importance signalized at his death by the execution of about half the number of his people.

SUPPRESSION OF SLAVERY.

I FREQUENTLY talked with these people, and explained to them the iniquity of slavery; but they argued: "We have a great deal of hard work in our trading expeditions to obtain these slaves; why should we leave them all behind us for others who have not worked? We have bought them, they are our slaves, and we have a right to do what we like with them."

The ceremony of execution, with its attendant brutality, ought to be, and can be, stopped. The bloodshed is even greater to-day than when Stanley first saw these people in 1877; the reason being, as I have before mentioned, that contact with white men has made them richer, and has enabled them to obtain more slaves. The great powers of the civilized world are now discussing the antislavery movement, and if such discussions should result in some united action directed towards the suppression of the trade in the interior, there are a few peculiar features which might be turned to advantage.

First, and most important, this traffic is not complicated by religious fanaticism of any kind.

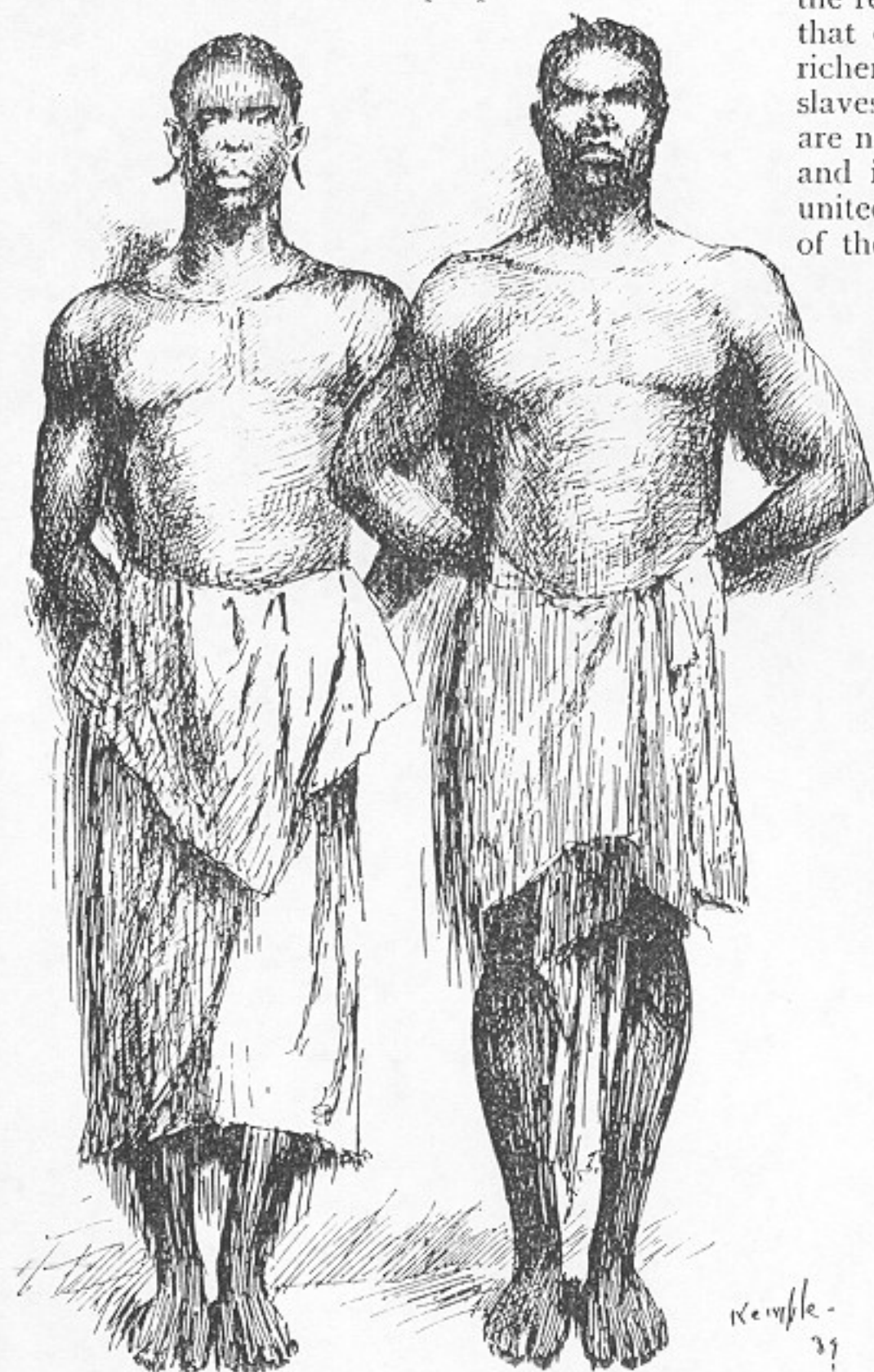
Second. These people are disunited; every village of fifty or sixty houses is independent of its neighbor, and small family wars are continually taking place.

Third. There is nothing so convincing to the African savage as physical superiority.

Now all these points are in favor of the antislavery movement.

The absence of religious fanaticism, the disunited condition of the natives, and their acknowledgment of physical superiority ought to be taken advantage of, and always borne in mind when plans for the suppression of the slave-trade and its attendant barbarism are projected. In my opinion, it will be some years before the slave-trade carried on by the Arabs can be successfully grappled with, but there is no reason why any delay should occur in striking a blow at the inter-tribal trade.

The Congo Free State has



TWO OF MY CREW.

Remble-
39

moved a step in the right direction by establishing near Stanley Falls an intrenched camp, with the object of forming a barrier to keep the Arabs, with their Manyema banditti, east of that position. Every country in the world should support the State to effect this object, as it will play a most important part in the history of Central Africa. When Stanley left Wadelai the Mahdists were already there. If these hordes join with those at Stanley Falls it will require most strenuous efforts to save the whole Congo Basin from their devastations. While we are still able to keep the Arabs east of the Falls, no time should be lost in eradicating the existing bloodshed west of that point. It is a big work, but it is a duty which the civilized world owes to the helpless slave. Although black, and a savage, still he is a human being. It should always be remembered that the suppression of slavery in Africa does not mean merely striking the fetters from the limbs of the slave; its end is not only the substitution of paid for forced labor, but also the relief of enslaved humanity throughout all these regions from a life of unspeakable horror, from tortures that only the savage African can invent, and from a certain and violent death.

From Banana Point to Stanley Pool slavery does exist, but of such a mild character that when operations are actually begun Stanley Pool should be the starting-point. If half a dozen fast boats were placed on the river at Stanley Pool, each armed with twenty black soldiers, officered by two or three Europeans who had proved by their past services that they were capable of dealing with the question, and if such a force had the recognition of the civilized powers and was allowed to strike a blow at the evil, thousands of human lives would be saved.

These boats would be continually moving about the river, and those in command would begin by making a careful study of local politics. They would have to convince the natives of their determination to stop these diabolical ceremonies of bloodshed. The natives should be warned that any villages which in the future were guilty of carrying out such ceremonies would be most severely punished. Some of the better-disposed native chiefs would have to be bought over to the side of the

white man. Spies should be engaged all over the district, so that a boat on arriving would immediately hear of any execution that was about to take place or that had taken place; and I would suggest that any village which still continued these acts of cruelty, after having been fairly and fully warned, should be attacked, and a severe example made of the principal offenders. A few such punishments would soon have a most salutary effect. These operations I should recommend to be carried on between Stanley Pool and the Falls. Posts should also be established in commanding positions to control the mouths of the slave-raiding rivers. Each point should be supplied with a boat such as I have recommended for the lower river. Other stations should be established in the center of the slave-raiding district. Slaves at the time in the markets might be redeemed and placed in some settlement, where they could be trained as soldiers or learn some useful craft. I have, whenever it was possible, purchased the redemption of slaves, and on the completion of such purchase have always taken the precaution to place in the freedman's hand a paper to the effect that he had been redeemed by me from slavery, and that the expedition I represented would make a specified payment per month while he remained in its service.

EFFECT OF LIBERATION.

IT was curious to observe the different effects that the announcement of such a redemption had on slaves freed so unexpectedly. As a rule, the bewildered man would go from one to another of my boat's crew, asking all sorts of questions as to the meaning of the ceremony. What was to be his fate? Was he to be exchanged for ivory? or was he to be eaten? And it would take some time and patience to explain to him, after his first surprise was over, the full import of the paper I had placed in his possession. Others, more intelligent, would immediately understand the good fortune that had befallen them; and it was strange to see the startling change in the expression of their countenances, which a moment before betokened nothing but unresisting acquiescence in their miserable destiny, and to note their inert and weary bodies, which seemed at once to become erect and vigorous when released.

from the degrading fetters.

After having bought all the slaves which were exposed for sale, warning should be given that any attempt to purchase human beings for slavery would be the signal for war, and that the purchasers would be severely punished.

The most important part of the movement is to convince the slaves of our earnestness and sincerity. I feel confident that should operations be carried on in the way thus suggested most satisfactory results would ensue.

The reason for the native villages being disunited is, that there seldom exists a chief strong enough to form a combination. This weakness should be taken advantage of, and capable white men might, through their personal influence, unite the tribes under their leadership. Sooner or later the Arabs at Stanley Falls will have to be battled with. At present they remain there, not because the white men will not allow them to come lower down, but because they are in the center of such a rich field, and they know that by coming down the river they must rely entirely on their canoes, as roads in the interior are few and far between, owing to the swampy nature of the land. They would also have the populous and warlike districts of Upoto, Mqobeka, and Bangala to fight against, which would not be so easily overcome as the small scattered hamlets around Stanley Falls, which at present they are continually persecuting.

All the natives on the Upper Congo, quite up to the limits at present reached by the Arabs, should be controlled as much as possible by Europeans. They should be combined together under Europeans, so that when the time arrives that the Arabs decide to move west they would be met at their frontiers by a barrier of well-armed and resolute natives.



COPPER ANKLET.

The slave-trade of to-day is almost entirely confined to Africa. The slaves are caught and disposed of in that continent, and the number of those who are shipped to Turkey and other

parts are indeed few compared with the enormous traffic carried on in the interior. We have the authority of Stanley and Livingstone and other explorers concerning the iniquity existing in the eastern portion of Equatorial Africa.

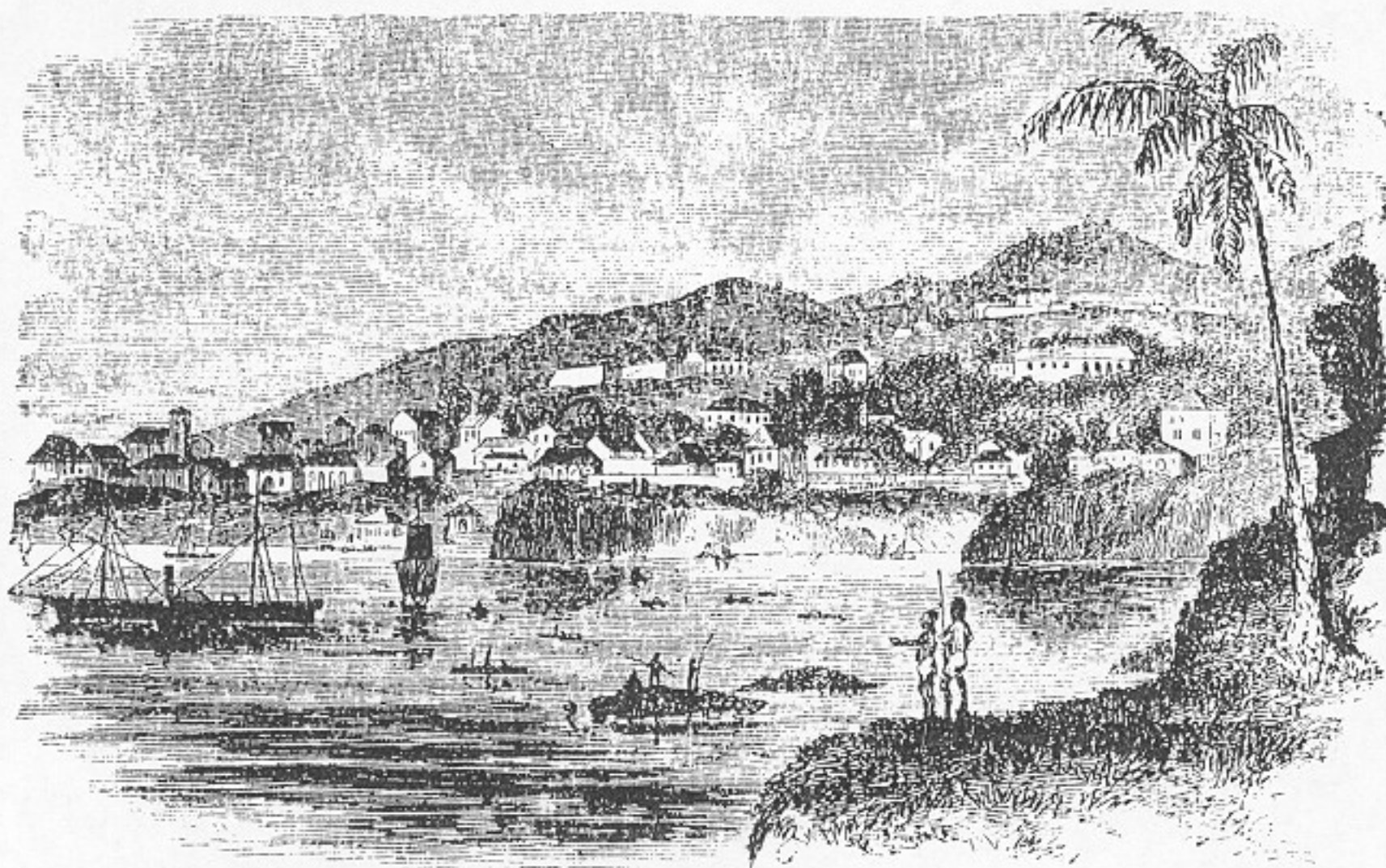
In India we have an example of what determination and resolution can accomplish; as the inhuman ceremonies of the suttee, car of Juggernaut, infanticide, and the secret society of the Thugs have all been suppressed by the British Government. The opportunities for reaching the center of Africa are yearly improving. Since Stanley first exposed to the world's gaze, in 1877, the blood-stained history of the Dark Continent, rapid strides have been made in opening up that country. The work for Africa's welfare so determinedly pursued by Livingstone has been most nobly carried on by Stanley, and the rapid progress which is at present taking place is due entirely to Stanley's efforts. A great obstacle has always existed between the outside world and Central Africa, in the stretch of unnavigable water between Matadi and Stanley Pool. The railway now being constructed will overcome this difficulty.

E. J. Glave.



HARPER'S NEW MONTHLY MAGAZINE — JULY, 1856

NEGROLAND AND THE NEGROES



SIERRA LEONE.

NEGROLAND AND THE NEGROES.*

TWENTY-FIVE hundred years ago—so Herodotus tells us—a company of Phœnician navigators sailed southward from the Red Sea on the eastern shore of Africa. Three years after, they passed the well-known landmarks of the Pillars of Hercules, on the opposite side of the continent, within a few days' easy sail from their starting-place. These mariners told how, as seed-time came, they had twice hauled their vessels upon the shore, planted a crop of grain, waited for it to grow and ripen, and then bearing it on board their hollow ships, had set off again on their adventurous voyage over unknown seas and along strange coasts. They related also that for a while they had seen the sun to the north of them. The Father of History was a man of large belief, but this report was too much for his credulity, and he repeats

* *Western Africa: Its History, Present Condition, and Future Prospects.* By Rev. J. LEIGHTON WILSON. Harper and Brothers.

it under protest; for in all his far journeyings he had never beheld the sun except to the southward. These Phœnicians were, therefore, the first civilized men who had ever passed south of the equator, or who had seen the western slopes of the mountains that girdle the African shore.

More than two thousand years passed before the veil was again lifted, for the Carthaginian navigators never reached further south than Cape Mount, midway between Sierra Leone and Liberia. It was not till near the middle of the fifteenth century that the Portuguese made their way to the Ivory and Gold and Slave Coasts. Fifty years later Vasco de Gama rounded the Stormy Cape, misnamed of Good Hope, and for the second time completed the circumnavigation of Africa.

Neither the Catholic missionaries, who soon began their operations on a gigantic scale, nor the traders who flocked thither for gold and ivory and slaves, added greatly to the stock of knowl-

edge respecting the people of Western Africa. It is to Protestant missionaries of our own country that we are mainly indebted for what we know of the natives of the Guinea Coast.

Mr. Wilson, from whose valuable work we propose to draw largely in this article, is probably better acquainted than any other man with the negroes of Western Africa. He has resided among them for almost a score of years. Once, in the earlier part of his missionary career, he chanced to fall among a cannibal tribe. They certainly had never heard of Sydney Smith, but manifested a particular desire to try the flavor of a bit of cold missionary. For seven years Mr. Wilson dwelt among the Krumen of Cape Palmas, and for a still longer time among the Mpongwes of the Gabun River, on the very line of the equator. He has thoroughly mastered the languages of these representatives of the two great negro races of Western Africa; has composed grammars and dictionaries of both languages, and has published books in them. He has either written or furnished the materials from which have been elaborated some of the most valuable contributions recently made to the sciences of ethnology and philology. A pamphlet on the Slave Trade, from his pen, fell under the notice of the English Government at a time when it was a matter of debate whether the British vessels should not be withdrawn from the Slave Coast; and as he has been informed by a letter from Lord Palmerston, this pamphlet decided the question in favor of the continuance of the effort to put a stop to the Slave Trade.

Whoever may sneer at the labors of missionaries, the philosopher and the scholar will not. They have added more than all other men to our knowledge of the uncivilized portions of the human family. Of these we have no hesitation in pronouncing the negro races of Western Africa to be the most worthy of attention. They are the ones who present most promise of a future career of civilization and Christianity. It is morally certain that a century hence there will not exist upon the face of the globe an individual of the copper-colored aborigines of North America, or of the brown races of Polynesia. Indications are not wanting that the Cingalese and Hindus will pass away before the conquering white races. We believe that the Chinese have had their youth and their man-

hood—such as it was—and that they are to go the way of the builders of Babylon and Nineveh, of Copan and Palenque.

The negroes, on the contrary, have shown that they can live face to face with the whites. In the West Indies they have multiplied in a condition in which the aborigines became extinct in two generations. We know how they have thriven, physically, intellectually, and morally among us. However much slaveholder and abolitionist may differ in theory and conclusion, they both insist upon the essential fact, that the colored race among us have made great advances, and are capable of and destined for still greater improvement. What the natives of the slave regions are at home, and what the country which they inhabit is, we may learn from the book of Mr. Wilson.

As we sail down the coast we pass the mouths of the great rivers Senegal and Gambia, winding through dense forests and thick jungles. Upon their banks grows the gigantic *baoba*, hugest of trees. The coast is under the control of the French and English, and is peopled by the Fulahs, Jalofs, and Mandingoes, the handsomest negroes of Africa, with tall elastic figures, woolly hair, and glossy black skins. The women, says one traveler, with a significant reservation, are as attractive as it is possible for black females to be. They are zealous Mohammedans, and are rapidly extending their faith among the tribes to the south.

At the flourishing settlements of Free-town and Monrovia we shall see a strange mingling of civilization and barbarism. The white man, rendered still paler by the wasting African fever, jostles the black emigrant from civilized countries, jauntily clad, and the sable denizen of the bush, with scarcely a rag to cover his nakedness. Free-town the chief settlement in the British colony of Sierra Leone, and Monrovia, the capital of Liberia, in spite of their unhealthy climate, may be fairly set down as successful experiments in African colonization. Monrovia, with its neat whitewashed dwellings and three or four churches presents an aspect not unlike that of American towns with a population of fifteen or eighteen hundred. Mr. Wilson makes the very sensible suggestion that the interests of both colonies would be materially advanced by the union of Sierra Leone and Liberia into one State. This new State would then have a very

decided preponderance in power over all of the native kingdoms on the coast.

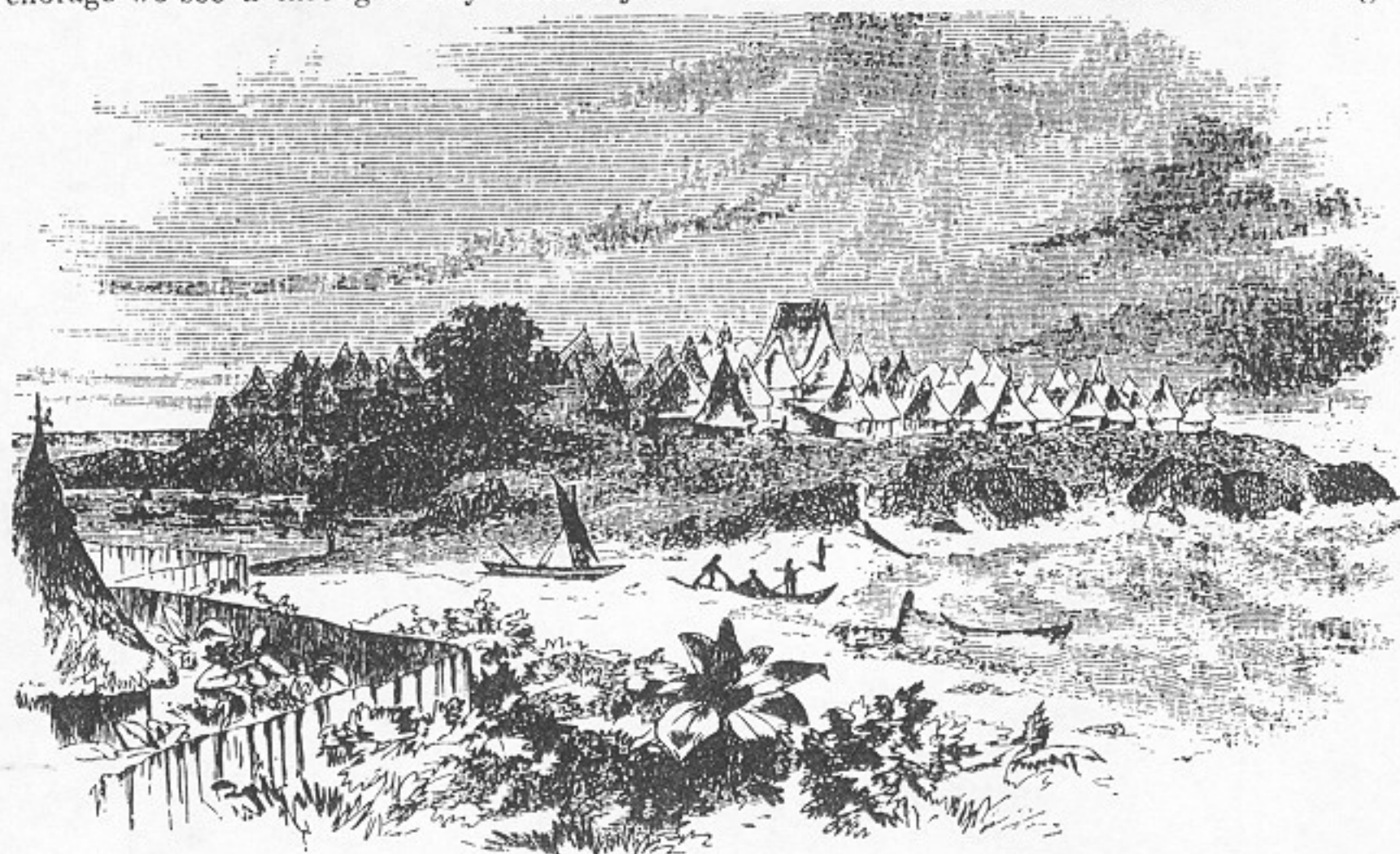
Leaving the settlements of Sierra Leone and Liberia, and the land of the Fulahs and Mandingoes, we pass down the coast to a country inhabited by negroes of another stock. This was once known as the "Grain Coast," not from its production of bread corn, but from the Malaguite Pepper, or "Guinea Grains," once its principal article of trade. It was formerly in great demand for giving flavor and potency to the ale and porter with which our transatlantic cousins comfort their thirsty souls. These "grains" have of late years been pronounced poisonous, and their consumption has fallen off. If we may credit Mr. Wilson, the poisonous quality belongs to a different fruit, which the natives were accustomed to mix with the genuine article, which has thus lost its reputation from being found in bad company. The country is very beautiful as we coast along. Here it spreads out into broad plains dotted over with groups of feathery palms; there it rises in wooded hills, or sinks in green valleys. The sharp conical roofs of native villages are beheld rising in every direction from among the foliage.

Long before our vessel has reached her anchorage we see a throng of tiny black objects

approaching us from the shore; as they approach they take the form of canoes, in each of which three or four brawny blacks, seated upon their bent legs, are paddling with all their might to be the first to reach us. These are the Krumen, and theirs is the beautiful country before us. The crew of the foremost canoe has clambered the side of our vessel, followed at a brief interval by the others. Their object is not theft or piracy; they wish to dispose of their labor, for a very moderate compensation.

In many respects these Krumen are the most interesting race of men on the African continent. Of late years they have become the principal laborers on all foreign vessels trading to the coast of Western Africa; and hence, though they have never engaged in the Slave Trade, Johnny Kruman is well known in every settlement from Goree to Fernando Po; and now and then he makes his way as a sailor to foreign ports. As the chances are that he has picked up a "white" nickname, and a tolerable supply of very questionable English during his various cruises along-shore, he manages to make himself quite at home in New York or Liverpool or London.

If a Kruman were to write his autobiography, his first recollections would be of having his



KRU VILLAGE.

eyes thoroughly rubbed with red pepper, which is the African substitute for the use of the rod. As he grows older he is sent into the fields to scare the birds away from the rice-crop. When he approaches man's estate he is hired out to some captain, with whom he engages to remain as long as the vessel stays upon the coast;—this may be for two months or two years. The sailors now undertake his education. The first thing is to give him a "Christian" name in exchange for his native appellation. Paphruo, or Blaino, or Barrakuo, becomes transformed into "Snowball," or "Frying-Pan," or "Pea-Soup." One supercargo, whose favorite author was probably Mr. Harrison Ainsworth, named his four oarsmen respectively "Nix," "My-Dolly," "Pals," and "Fake-Away," so that in manning his boat, he was obliged to repeat the slang phrase of the London crackman. The days of the week are also commonly used as names, the favorite of all being that borne by the faithful companion of our old friend Robinson Crusoe. A month's wages are paid in advance to the father or "head-man" by whom the young Kruman has been put on board; and the vessel sails away to complete her cargo on some other part of the coast. When she finally leaves, Friday ships on some other vessel, and it may be years before he finds his way back to his native village.

If by good fortune he returns to his family with a tolerable share of his accumulated wages, in the shape of cloths, guns, cutlasses, and the like, he at once becomes the lion of the village. The fatted calf is killed, guns are fired, and dances got up in his honor. He is a credit to his family, and must be furnished with a wife at once, as the first step toward taking his stand as a man of rank and respectability. Negotiations are set on foot for the purchase of a young girl; the price is agreed upon, and duly paid, and the bride is transferred to the charge of his friends. The first step has been taken, but more is to be done, for among the Krus, and in fact throughout all Africa, a man's position in society is measured by the number of his wives, quite as strictly as it is in civilized countries by the state of his bank account. He therefore sets off again, and in a few months returns with goods enough to buy another wife. In due course of time he becomes a head-man himself, and makes a profit upon the young ad-

venturers whom he hires out. If he has good luck, by the time he is forty or fifty years old he has obtained a dozen or twenty wives, and is able to retire from business and lead the life of a gentleman of fortune and leisure. Very likely also he has inherited a number of wives by the death of a brother or uncle; for the wives of a deceased Kruman, like other property, fall to the share of some kinsman, thus keeping up the respectability of the family.

When a Kru gentleman retires from active business his domestic arrangements are wonderfully like those of our own respected fellow-citizens, Brigham Young and the other magnates of Utah. If he has any regard for "what is expected" by society, or any desire for a quiet life, he must provide a separate house for each of his wives. These he builds as close together as possible, and for the sake of privacy usually surrounds the whole with a palisade. Each hut consists of a circular wall, five or six feet in height, and from ten to thirty in diameter. Upon this is fitted a high conical roof of thatch, the eaves projecting several feet on every side. The floor is of clay, beaten hard, and sometimes paved with cocoa-nuts, which by constant friction shine like bronze globes. The fire is built upon the floor, the smoke, in default of a chimney, making its way as it best can through the thatch. Each house usually consists of but a single room, though among the upper ten one corner is sometimes partitioned off for a sleeping apartment. The furniture is of the simplest kind: a few pots, and bowls, and plates, a couple of mats for beds, wooden blocks for pillows, and a pine chest by way of wardrobe,

make up the list. These, with the fondness for display innate in the African, are made, as far as possible, ornamental as well as useful. The tin washbowls and gay colored earthen plates procured from foreign vessels have holes punched in their edges, and are suspended from the walls in place of mirrors and pictures. The sleeping mats are neatly rolled up and put away, for to do the Kru matrons justice they are wonderfully clean-

ly and industrious, as well as good-humored. Higher qualities than these must be looked for in vain so long as the system of polygamy prevails.

His patriarchal establishment thus arranged, with a bevy of stout wives to attend to his wants and perform the hardest part of the labor, our Kru gentleman sets about enjoying his well-earned leisure. The cultivation and harvesting of his rice and cassava keeps him tolerably busy for three or four months in the year; the rest of the time he is a gentleman of means,



KRU HOUSES.

with just business enough in hand to give him pleasant employment. He gets up in the morning at such hour as he pleases, saunters about his establishment, plays a little with some of his many children, and when he has gained an appetite, drops in to breakfast with one of his wives.

The Kru *cuisine* is rather limited. Animal food is used sparingly—though in this department nothing comes amiss from a leopard to a wood-rat—and chiefly in the form of soup, so hotly peppered as to defy the palate of an East Indian. Cassava and rice are the principal articles of consumption. The Kru housewives are famous for their skill in boiling rice; and when the snowy contents of the pot are deposited into a clean wooden bowl,



AFRICAN BELLE.

and the fresh, fragrant palm-oil poured over it, a man might go farther for a breakfast and fare worse. It takes time for a European to become reconciled to their mode of eating, which consists in thrusting the hand into the dish, rolling rice and oil into a ball, and then, with mouth open and head thrown back, flinging the savory mass down the throat. Not only are knife and spoon dispensed with, but even teeth seem to be of little use, which is the more remarkable, because the Krumen pride themselves greatly upon the beauty of their "ivories," and show a praiseworthy neatness in cleansing them before and after every meal.

The demands of fashion in regard to clothing are easily satisfied. A gentleman is well dressed with a strip of cotton, a couple of yards long, around his waist; a still shorter piece suffices for the costume of a Kru lady. A hat, and a large square cloth thrown over the shoulder, are proofs of very decided wealth in the wearer; the addition of a European hat and a sailor's jacket constitutes a dandy. By way of ornament, the women wear as many brass and copper rings and armlets as they can procure; but for men a broad ivory ring, upon which some friendly sailor has carved the owner's name, is held to be in better taste. 'Tigers' teeth, strung together, are a favorite ornament; but the most *recherché* of all is a species of blue bead, brought from the Gold Coast.

Respectable and easy as the life of a retired Kru gentleman may be, it is more than doubtful whether his domestic happiness comes quite up to his expectations. Like many another man he finds that a large establishment involves a deal of trouble. In spite of their separate huts, jealousies will now and then arise among his wives, and quarrels among their broods of children. To settle all these would tax the wisdom of Sancho Panza, while to endure them would try to the utmost the patience of Job. Not unlikely the respectable husband of a score of wives may look back with regret to his sailor days, when he was "chaffed" by the crew, "hazed" by the mate, and liable to be knocked down by the captain.

Yet it is wonderful with what tenacity polygamy is clung to by every people among whom it prevails. The Krumen is quite sure that its advantages outweigh the disagreeable accompaniments. If a man had but one wife, he

reasons, how could he get his breakfast when she happened to be sick or absent? If she should chance to be out of humor, as will sometimes happen to the best of women, how could he entertain his friends as a gentleman should? So, on the whole, he votes for polygamy. The women too, strange as it may seem, are equally in favor of it. No respectable Kru family will sell their daughter, and no girl of any pretensions would willingly be sold, to a man who was supposed to be so deficient in enterprise and ambition as to content himself with a single wife. She would scorn to be connected with so humble an establishment. As well might a young American hope to induce a Fifth Avenue belle to share with him the limited paradise of a single room in the fourth story of a third-rate boarding-house.

The government of the Kru people is a pure democracy. Every village, or group of villages, constitutes an independent community, which may number from a few hundreds of souls, up to ten or twelve thousand. In every village a large square "Palaver House" stands conspicuous in the midst of the circular huts. Here all public business is transacted. Every male adult is considered a member of the body politic, though the young men, or *Kedibo*, occupy a subordinate place. Next come the *Sedibo*, or soldiery, comprising the great body of middle-aged men. A man, before being enrolled in their ranks, must pay a fee; this is usually a cow. These form the effective strength of the community, and are not a little apt to be rapacious and overbearing. The old men, who have passed the period for active service, constitute the *Gnekbade*, or Senate. Their influence is very great; and, in ordinary cases, their decisions are law, though it sometimes happens that they are overruled by the *Sedibo*, yet always with a show of great respect for the elders. At the head of the Senate, in time of peace, is the *Bodio*, whose functions are mainly those of a high-priest. He takes charge of the national fetiches, and is entitled to certain choice bits from every animal that is killed for food. His house is a sanctuary, and no culprit who takes refuge there can be removed without his consent. He is held responsible for the general prosperity of the community. If the harvests happen to be unproductive, or the season unhealthy, if the fishing fails, or ships do not fre-

quent the coast, the blame is laid upon the Boddio; and in case the evil is prolonged, he is liable to be deposed. His official insignia—a huge iron ring worn around the ankle—is looked upon with as much reverence as is paid to the circlet placed upon the head of her gracious Majesty Queen Victoria, or the iron crown of the Hapsburgs, with its veritable nail from the true cross.

Public business is conducted with great gravity and decorum. The members of our Congress or of the English Parliament might learn some valuable lessons from a Kru "palaver." Every man brings his own stool, and takes his proper place in the assembly. The discussion is opened by some one appointed for the purpose. He advances into the centre of the circle, bearing a long staff in his hand. "*Bateo*—Listen," says he. "*Bate*—We are listening," respond the auditors. When he has concluded his speech, he places the staff in the hands of some one else who desires to speak. There is no dispute as to what "honorable gentleman" is entitled to the floor. That is settled by the possession of the staff. "Admirable specimens of oratory," says Mr. Wilson, "may be heard in these African assemblies. Their popular speakers show almost as much skill in the use of happy illustrations, striking analogies, pointed arguments, historical details, and biting irony as any orators in the world; and for ease and grace of manner they are unsurpassed." When all the younger members have spoken, the Senate give their opinion, and then the whole matter is decided by popular vote.

The Gnekbade performs likewise the office of the Roman Censor. When a man is suspected of growing too powerful and proud for the safety of the State, or, as they phrase it, "got too much sass," he is forthwith mulcted in a sum that reduces him to an equality with his fellow-citizens.

Passing the low Ivory Coast, where the long, unbroken swell of the ocean dashes furiously upon the sandbank which lines the shore, as we approach the equator we come to the region where the Slave Trade formerly had its chief seat. Almost every point and headland is crowned by a fort, erected by Europeans to protect this unholy traffic. Twenty-five of these are found within a space of two hundred miles. Since the trade in slaves has been almost wholly

suppressed to the north of the equator, the greater portion of these forts have fallen into decay. Elmina, however, the first fortress erected by the Portuguese, now in the hands of the Dutch, is still kept in good repair, and strongly garrisoned. Cape Coast Castle, the residence of the British Governor of the Cape Colony, is a still more imposing fortress. Its walls inclose several acres of ground, and are mounted with more than a hundred guns. In the centre is the tall castle, the residence of the Governor. It has a garrison of natives and blacks from the West Indies, under the command of English officers. Here, a few years since, the brilliant and lamented "L. E. L." closed her earthly career. Whether by a sudden paroxysm of a disease to which she had long been subject; or by an accidental over-dose of prussic acid, taken as a remedy; or by voluntary suicide from weariness and despondency, no man knows with certainty. Her remains lie in the court-yard of the castle, the parade-ground of the garrison. A small marble tablet, with a Latin inscription, inserted in the wall opposite, commemorates her genius and her untimely fate. Her true monument, under another sky, is built of words and thoughts, not of marble or granite.

The two military despotisms of Ashanti and Dehomi furnish the only striking exceptions to the democratic communities of that portion of Western Africa lying north of the equator.

Ashanti, with its tributaries, contains some four or five millions of inhabitants. Its government is one of the most thorough despotisms in the world. The king is absolute master of the lives of every one of his subjects, and he maintains a system of espionage in his dominions which would do credit to the ingenuity of Fouché or Orloff. When a noble is summoned to the royal presence, he feels that he goes in peril of his life. He may be called to receive high honor or severe punishment. He may be about to gain some distinguished mark of favor, or to hear that his blood is required to water the grave of some member of the royal family. In either case he has nothing to do but to submit. Though the king is the heir to all the property of his subjects, he usually allows the family of a deceased person to retain all the gold which may have been wrought into ornaments. It has hence grown into a custom with the rich men to

put as much of their wealth as possible into this shape. Once in the course of his life every man is allowed to make a grand display of his wealth in the streets of Kumasi, the capital. He arrays himself, his wives, and servants, in their richest robes and most splendid ornaments, and parades through the city. The amount of gold thus displayed is sometimes almost fabulous; for Ashanti is one of the richest auriferous regions in the world. The soil is every where impregnated with gold, even in the streets of Kumasi. With such abundant sources of income, the King of Ashanti is probably by far the richest man in Africa.

Here as elsewhere a man's importance is estimated by the number of his wives. The King is prohibited from exceeding the number of three thousand three hundred and thirty-three. It is not known whether he is obliged to keep up the full complement. During the working season they are dispersed through the country, engaged in agricultural labor with their own royal hands. For the remainder of the year they are collected in Kumasi, occupying two long streets, where they are kept in strict seclusion. It is a capital crime for any man to look upon them. Sometimes they are paraded through the streets, preceded by a company of boys to warn the people to hide themselves. Those who have not time to get out of the way fling themselves down with their faces to the ground, where they lie till the procession is out of sight. Now and then, upon some extraordinary occasion, this strict rule is relaxed, and the galaxy of sable beauty may be beheld without its costing the life of the spectator. When the British Embassy was received, the King appeared in public surrounded by three hundred of his favorite wives. He was seated upon a throne encased in massive gold, his royal person enfolded in rich silken garments, with neck, arms, ankles, fingers, and toes covered with golden rings; while all his attendants were furnished with golden arms and implements of every description, brought forth from the royal treasury.

But the despotism of Ashanti pales before the still darker and more bloody absolutism of Dehomi. The King is regarded by his subjects as a demi-god. It is a grave offense to imagine that he eats or drinks or sleeps, like ordinary mortals. His meals are taken in the utmost privacy, and the wretch who should chance to

see him thus engaged would be put to death on the spot. Upon certain great occasions he so far lays aside his divinity as to condescend to drink in public; but even then a curtain is interposed between him and his subjects, who prostrate themselves in adoration while he is supposed to be imbibing; and when the operation is over they rend the very heavens with their acclamations.

He is absolute proprietor of the country and every person and thing in it. The females especially are his peculiar property. No man can have a wife except by his permission. They are either sold or given as rewards for distinguished valor. The sale takes place but once a year. The price is fixed at a uniform sum, and the buyer has no privilege of choice. He must content himself with such one as his Majesty pleases to assign.

One of the most singular institutions of Dehomi is the famous body of Amazons, which constitute the *élite* of the army. Their number at present is about 5000, armed with muskets and all the weapons of African warfare. A few years ago, when the English embassy was residing in Dehomi, the king made, for their amusement, frequent displays of this favorite band. They performed all sorts of sham-fights, in order to show off their strength and dexterity. These strong-minded and strong-armed Amazons become more masculine than the men themselves, and when one wishes to reproach another for weakness or cowardice, she can find no more emphatic epithet than to say, "You are a man!" Their superior prowess has been quite recently displayed in a remarkable manner in connection with one of the most singular episodes of African history.

Between Dehomi and the River Niger lies a country known on the maps as Yoruba. Many years ago it was a powerful state, under the rule of a single sovereign. This was at length broken up into a multitude of petty governments, and became the favorite hunting ground of the slave-traders. Some forty years since the remnants of a few feeble tribes sought refuge in a famous cavern about seventy-five miles from the sea-shore. Here they secreted themselves, living upon roots and berries, and such food as they could find growing wild about their lurking-place. Other fugitives flocked to them, until the fragments of more than a hundred

tribes were gathered in this place. They called their settlement Abeokuta, or "Understone," in memory of the cavern which had given them shelter. About fifteen years ago a number of liberated slaves from Sierra Leone came on a

trading expedition to this part of the coast, from which some of them had been originally stolen. They carried back with them tidings of the settlement of Abeokuta; and a large body of civilized and Christianized freedmen from Sierra

Leone at once determined to rejoin their countrymen. Between the years 1839 and 1842 these emigrants numbered five hundred. This infusion brought new life to the community, and in 1853 its inhabitants numbered more than a hundred thousand. Missionaries were sent out to them, and their efforts met with a degree of success without precedent in Africa. Abeokuta assumed the aspect of a civilized and Christianized community. About three years ago the King of Dehomi resolved to extirpate the new community, and marched against it at the head of a large army, including his female invincibles. It happened that an American missionary, Mr. Bowen, who had served as a soldier in our late war with Mexico, was at Abeokuta. He saw that other weapons than preaching must be employed against the savage invaders, and set about training the people for the contest. The Dehomans were beaten back after a desperate struggle, and their king himself was saved from capture only by the bravery with which his regiments of Amazons defended his person.



TOKO—A GABUN CHIEF.

THE CENTURY MAGAZINE — FEBRUARY, 1890

THE REALM OF THE CONGO

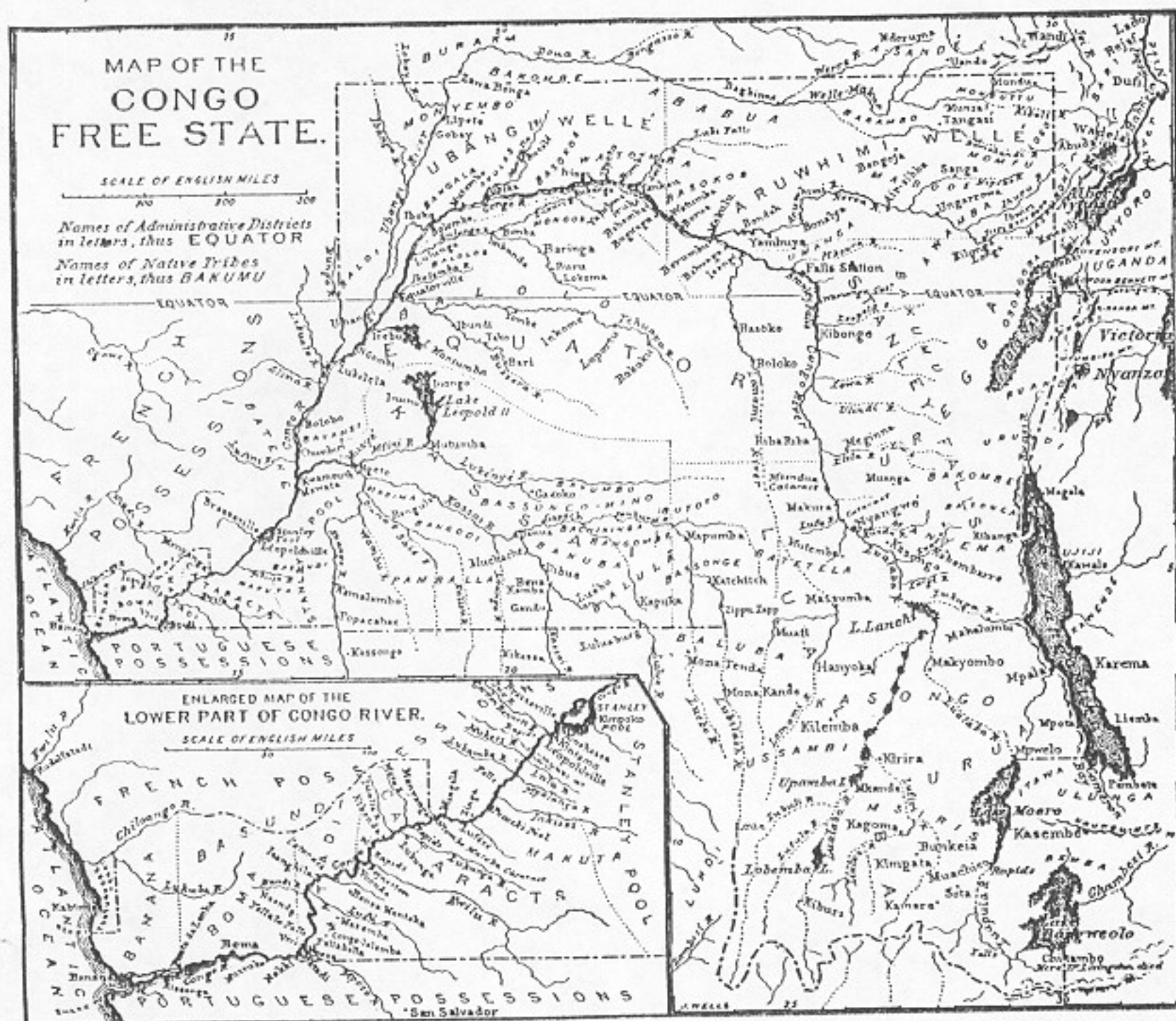
By the Commissioner of the United States —

W. P. Tisdale

Banana possesses a motley population of about six hundred negroes; some are native slaves, some Kabindas and Loangos, while not a few are from the Krumanos of Sierra Leone and lower Liberia.

When we came into Pallaballa we learned that the king—who was absent at the time—had instructed his son not to allow any white men to stop in the place before his return. He had gone to pay tribute to the king of San Salvador, from whom he had received a letter.

I saw the letter, which was written in Portuguese, undoubtedly by a Jesuit priest. The king's son said we could not stop in the village. I was annoyed to think that I could not stay in the place overnight, so I called my interpreter, and told him to say to the king's son that I would be glad if he would allow me to stay there; and if he did so, without molesting me, I would give him a handsome present in the morning. He said no, I could not stop there; we would have to go on. But we were



very tired, there was no water outside of the village, and we decided to stay whether or no. In most of the villages near the river where whites have appeared, the kings, as a rule, set apart a little hut which they give to traders who happen to come into the village, allow them to sleep at night in the hut, and then take something in the way of presents from them in the morning. I informed the king's son that if they allowed us to stop I would give them presents in the morning, but if they made us trouble we would burn their village. We were permitted to "turn in" without molestation, but about one or two o'clock in the morning the chief of Pallaballa himself put in an appearance. He had made the trip from San Salvador, some seventy-five miles or more, in three or four days; but he had been drinking with kings on the way, and was very drunk. He wanted to drive us out of the place. But he was very easy to handle; a little trade gin soon put him to sleep, and we were not molested. In the morning we got ready to start, when Pallaballa and all his ministers put in an appearance and wanted their presents. I gave Pallaballa some handkerchief stuff, a red cotton umbrella, a bottle of gin, and a string of beads. Then I gave all his ministers a drink of gin, and they were very happy.

The chief began to tell me what a good friend he was to the white people, and he wanted to show me a treaty which he had made with Stanley when he passed through the country the last time. He went into his old hut and brought out the king's box. He had it tied round and round with strips from the bark of the palm tree. The old fellow opened the box and handed me the treaty—as he supposed. I found it to be a letter written in the Portuguese language, purporting to come from the king of San Salvador. This letter went on to compliment Pallaballa, and wish him every success in the world, and suggested to him that he should keep the white men out of his country; and after advising him what to do, it wished him well, and hoped he would not forget to send three or four bottles of gin. I said: "Old man, you have made a mistake. This is not the Stanley treaty; this is from Salvador." The old fellow was very much excited, and grabbed the document away from me. He then handed me another document, which was a treaty that he had signed with

Stanley a long time ago, and bore date of Stanley's last passage through the country. After I had satisfied myself that the old man was friendly to us, I asked him to tell me why he was opposed to the white men stopping in his town overnight. He said: "I will tell you. We have not had any rain up here for a long time." And he went on to tell me that the palm tree would not yield *malafu*,—a fermented drink,—the ground nuts were not growing, and they were afraid of a famine, and he knew that the white men down the river at the camp had kept the rain back, and he believed that if he punished the white men as they came along the rain would come.

At the same time it was preferable to keep away from villages, because the Houssamen whom I had were very much feared by the people, as they were great thieves, and invariably got us into trouble at every town we went to. When I came to Congolalemba, however, the king, who was a very pleasant fellow, seemed to receive me very cordially, and asked for a palaver, or council. The king and his ministers took seats on the ground. He said I was welcome to stay in his place. But while we were talking I noticed a great activity among his men, and I told my interpreter to go to some of the people and find out what was the matter. He came back and told me they were going down to fight Pallaballa. Before going to war in those countries they give notice that they will attack the next day. They never make an attack unawares. They were going to march that night and attack Pallaballa the next morning. I asked the king why he was going to fight Pallaballa, and he said the sap had run dry in the palm trees, and the ground nuts would not grow, and Pallaballa had kept the rain back.

Congolalemba began his march on Pallaballa, but during the night there came one of the most violent storms they had ever had in the country. The warriors passed the entire night in the rain, and when daylight came they did not want to fight. They made up their minds that Pallaballa, knowing they were coming, had relented, and so they went on to Pallaballa's village, got drunk, and had a glorious time for several days.

The women do the work of garden making and marketing, while the men roam listlessly

about, with no apparent object in view.

There is nothing about the natives of the Congo region to convince me that they have ever lived in a better condition than they do to-day. They are as low as the lowest. They have no intelligence. They have no written language. I have seen in the lower region of Africa a chimpanzee with more intelligence than any negro I ever saw on the Congo. I saw one chimpanzee that had fallen into a trap and was brought down to the Dutch station at Banana. They called him Leonidas. As he grew they became strongly attached to him, and detailed a slave boy to take care of him and instruct him. They made a little hut for him, and gave him a bunk much like a steerage berth in a steamship, and Leonidas would go in there and go to bed like a little man. He would sit at table and take his food like a native. I have seen him drink gin, smack his lips and slap his hand down as though he enjoyed it. He would give the boys a slap in the face if they annoyed him; and I noticed that the negroes esteemed him very highly.

As

I went up on the beach, I found a white man named Stanhope; he wanted to know where we came from, who we were, and all about us. I told him that I was the American commissioner to Congo. He said, "You have come to a fine place. I am surrounded by five or six hundred men. My house was blown down by a hurricane a few nights ago." He had no shelter, no food, and the negroes were as thick as possible in the valley below him, and they were occasionally firing upon him, and had promised him a massacre during the night. Captain Sãulez was with me. He was an African fighter, a man of good judgment, with a great deal of nerve; he at once took command of the forces. I walked with him out on the brow of the hill; we looked through our glass and saw

the position of the natives. They were going about in the grass and closing in. We asked Mr. Stanhope what occasioned all this trouble, and he told us it was a matter of trade between the tribes over the river. But we found afterwards that the immediate cause was his having flogged the son of the king, who had stolen from him or committed some other offense. He gave him a hundred lashes and let him go home to his father.

We made a little reconnaissance down the valley, and made fires to deceive them as to the number of our men. Finally in the night we held a palaver. I sent them presents, such as I had, and gave them a piece of paper with which they could go to a station several days' march away and draw what they wanted of beads, cloth, and brass rods. In that way I probably saved the life of Mr. Stanhope and his little band. I stopped that night with him, and the next morning started at the break of day, running many fierce rapids, and arrived safely at the station of Isanghila, from which place I marched through the Bundi valley, a country filled with serpents and all sorts of poisonous insects, and, after four days and a half, reached Vivi.

On the Congo there are no beasts of burden, there existing merely a manual transport, the porters being the natives of the Bakongo tribe, inhabiting the cataract regions. In physique these men are slight and only poorly developed; but the fact of their carrying on their head from sixty to one hundred pounds' weight ~~twenty~~ miles a day for sometimes six consecutive days, their only food being each day a little manioc root, an ear or two of maize, or a handful of peanuts, pronounces them at once as men of singularly sound stamina. Small boys of eight and nine years old are frequently met carrying loads of twenty-five pounds' weight.

HARPER'S NEW MONTHLY MAGAZINE — MARCH, 1873

AUNT EVE INTERVIEWED

By Frank B. Mayer

AUNT EVE was a superannuated negress, whose daily perambulations brought her to the kitchens of many families in Baltimore whose sires she had known in their childhood, and whom she had long outlived. The recipient of unconsidered trifles, she acknowledged these favors by the performance of small services, which rendered her welcome to the domestics of the households, among whom she was a historical oracle. As a link between the past and the present, let her speak for herself as she sits sipping her morning coffee by the fireside:

"Your sarvant, Sir. How's you and your

wife, and all de children, maaster? I hopes you're all well. Bless de Lord! I'm broke, sonny—poor as a snake; pick up a bone here to-day and dere to-morrow.

"Near as I can come, I'm a hundred and four year old. I was born and bred 'fore Washington's war here in Baltimore, near Henshaw's church, in Sharp Street. My ole maaster's been dead fifty year, but I can 'member very well, for all dat. Ole maaster's father was English captain; ole mistuss's father was sea-captain too. My own father was a Guinea man. Lordeer was my father's name, but maaster changed it to

Nero when he bought him.

"Ye see, Guinea's a big place. Niggers dere allers a-fightin'. Dey ketch one another, and sells 'em to de ships for guns and powder, beads, check and calico, and red flannel—de French great for red flannel—and dat's de reason so many's come in dis country. Dey used to come in ship-loads, like de Irish do now, till ole 'Tyson'—he was a Quaker, mind ye, and did a heap for de colored people—till he said dere should never no more come here. Dat was after de Revolutionary war. When he died all de niggers went to de burial. Ole mistuss said he was de niggers' god.

"In Guinea—'spects it's like Californy is



AUNT EVE.

* Nathan Tyson, an eminent philanthropist and early abolitionist.

now—dey digs gold all day, and when dey finds a big lump—so de Guinea niggers told me—dey go home and kill a chicken or a goat, and puts de blood on de lump of gold. Dat's deir way of giving God thanks. Den dey makes rings and bracelets of it. Maaster bought ten head—some from Mandingo, some from Soso; Father Jack and Sampson come from Missmygwongea—dat's another place. Paragratter, Vando, and Gombo was Gonah women.

"My own father was Guinea man. I'm good breed, caise I'm de royal blood; tell you for why—grandfather was de king's son; he come from de Wombo country; dat's what dey called it. It was a Gonah man taught me dis Guinea talk:

'Wullah, wullah, wuttoongah,
Se bungah looyah,
Coozen mooten lemba,
Hooden mat'na singa.'

I don't know what it means, but ef I'd kep in de sperit of it den I might 'e learnt. Worst of it is, I never could learn to read. Ye see, I was young, and so foolish! Dere was a lady wrote to ole maaster to know if she might teach me to read, but he sent word to know if she wanted to teach his niggers to run away. I might 'e learnt unbeknowns to him, but I was so young and foolish like.

"I don't 'member much of de Resolutionary war, but I knowed when it was. I was small den, but I had a good head. I toted wood and water, and warmed de chile's vitels."

The town of Baltimore was laid off by the county surveyor January 12, 1730. In 1752 there were twenty-five houses, four of which were of brick, nearly all having "hipped" roofs. The present population is 300,000.

"Baltimore was very open place den; streets was nothin' but mud and mire; ladies always wore clogs. Most all de houses was frame, Dutch roofs, hipped roofs; some was brick, but no touch

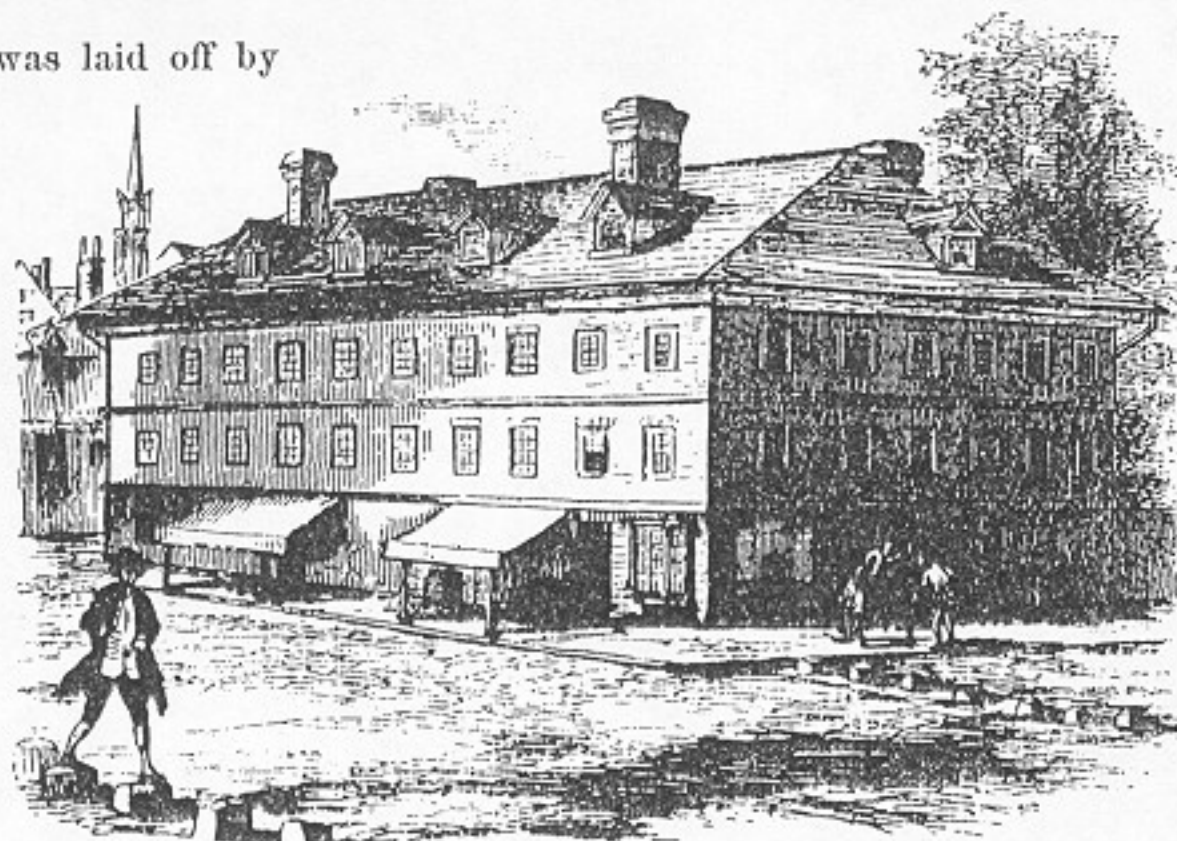
to what it is now! Market Street was all mud an' mire. De quality lived in Gay Street. Dere was old Congress Hall, where dey had balls and dancin'. I b'lieve it's standin' yet, if dey hain't torn it down. I could show ye where it was, in Liberty Street, though I ain't got but one eye now."

Congress assembled in Baltimore on the 26th December, 1776, and occupied Mr. Jacob Fite's house, being then the farthest west, and one of the largest in the town, and was a long time called "Congress Hall." None of the streets of "Baltimore Town," except here and there on the side ways, were paved until 1782.

"Dey don't have no fairs now, as dey used to. All dere by Congress Hall every Thursday in October, when de races was, dey was sellin' cakes and liquor, and eatin' and drinkin'; dey couldn't get dem all cleared off 'fore Sunday mornin'. De race-course was in de ole fields near dere, so thick of houses now I can't tell ye 'xactly where it is.

"Ye didn't see wagons and carts, as ye do now. Every Friday night all de country people come in with deir butter and radishes and greens, and so forth—cayed dem all a-horseback—twenty, thirty pounds o' butter in de boxes, slung across de horse's back. Dey used to cay dem dis way till it got so bad with robbin' de women and takin' all dey had. Ridgely's women was

"IT WAS GREAT TIMES IN TOWN WHEN DE COURT SET."





"TOTED WOOD AND WATER."

robbed; and dey took horses and butter and every thing as dey was comin' down to market. Dey never ketched de robbers! Arter dat dey had wagons and carts.

"It was great times in town when de court set. Maaster was great man 'bout de court; he was County Justiss; he always wore a scarlet vest, sometimes scarlet cassimere coat too, and had a tall cane.

"And den when de ships come in from England, dere was great rejoicin' and feastin' over it. Dey brought de elegantest English goods. Town's monsus full o' goods now, maaster! Ef de British was to come dey'd ruin many a one, but dey wouldn't ruin me, for I ain't got any! De ships brought a great many English sarvants to be sold here: six-year, seven-year sarvants. But when dey worked deir time out dey had to go free, and ye was obleeged to give 'em a gun, a good suit of clothes, and a mattock."

Besides negroes, there was another species of servant in the colony of Maryland, of whom frequent mention is made, and who in time became a large portion of the population. White emigrants, who were unable to bear the expenses of a voyage to the New World, or to maintain themselves upon their

arrival, bound themselves to serve for a limited number of years any one who would advance them the necessary funds. In time this grew to a considerable trade. The indentures were made to the captain of the ship, or some other person, and upon their arrival in the colony their unexpired time was sold to the highest bidder, to whom their indentures were then transferred. In the early ages of the colony they were called *indented apprentices*; afterward the general term of *redemptioners* was applied to them. These, upon the expiration of their term of service, became useful citizens, and enjoyed the same franchises as their more fortunate masters.

"Ye know, the laws must 'a been good for somethin' then! Never had sich laws sence old Sam Chase and lawyer M'Mechin and Martin. Dey daasent strike a gentleman's sarvant den but dey had to go to de court and answer for it! If ye was right, dey'd see ye righted! Since dey took de beggars up, and druv de gentlemen off de streets, de laws ain't been worth a chaw tobacker! Now dese shoe-makers and bridle-makers has de upper hand—it's jest played de old boy and Tom Walker.

"Den dere was allers somethin' lively in town. De Indians dey was a straight, proper people—a very neat, genteel people; dey come in every fall from de back places with buckskin, moccasins, baskets, and so forth, and tomahawks and scalpin'-knives too. Dey used to be all over dis settlement once. Many a time I've been hoein' corn, and I find arrow-heads and stone pots; dey fit with one and dey cooked in t'other. Now dey're all gone: I hope de Lord 'll take care of me!

"Dere was a fine den on tea. Once mistuss seen a man comin', and she took de eaddy off de table and hid it under her gown tail. Den dere was a man used to come along every now and den and take a list of all de silver and every thing of de nigger kind; ye paid so much for it—if ye let him see it."

If the tea-party at Boston has been thought worthy of renown, the tea-burning at Annapolis, open and undisguised, should not be forgotten.

In August, 1774, the brigantine *Mary and Jane*, Captain George Chapman, master, arrived in St. Mary's River with several packages of tea on board consigned to merchants in Georgetown and Bladensburg. The Com-

mittee of Safety of Charles County immediately summoned the master and consignees before them. The explanations and submission of these gentlemen were declared satisfactory; and as the duty had not been paid, they were discharged on the pledge that the teas should not be landed, but should be sent back in the brig to London.

On the 14th October the brig *Peggy Stewart* arrived in Annapolis, having in its cargo a few packages of tea. The duty was paid by Mr. Antony Stewart, the owner of the vessel. This submission to the oppressive enactment of Parliament called forth the deepest feeling. A public meeting was held; the owner of the vessel and the consignees in the most humble manner apologized for their offense, and consented to the burning of the tea. But the people were determined to exact a more signal vindication of their rights. The easy compliance of Mr. Stewart with the act had aroused their anger, and threats were poured out against his vessel and himself. Mr. Stewart, to soothe the violence of the people, and to make amends for his fault, offered to destroy the vessel with his own hand. The proposition was accepted; and while the people gathered in crowds upon the shore to witness its consummation, Mr. Stewart, accompanied by the consignees, went on board the brig, ran her aground on Windmill Point, and set fire to her in presence of the multitude. So obnoxious had tea become that wherever it was discovered its owners were forced to destroy it. Two months later the people of Frederick, having met at Hagerstown, compelled one John Parks to walk bare-headed, holding lighted torches in his hands, and set fire to a chest of tea which he had delivered up, and "which was consumed amidst the acclamations of a numerous body of people."

"When de tea and sugar and salt was throwed overboard, maaster said dere would be war. So we moved to Green Spring Valley, to ole Maaster Robert's place. Mistuss wanted to go further, to Fredericktown, but maaster wouldn't. Warn't dat a stylish place though? I worked twenty-three year on dat plantation arter maaster died. Things was cayed up de country—some things never got back. When we got dere dey had no other house but dat one room in de old tiny house, 'hind de parlor now, kivered with oak shingles, and so forth. So maaster got a house from Dr. Walker, and



"GENTLEMEN DRESSED ELEGANT TOO."

put ole Mother Grace and Phebe and us to stay dere till de new house was built. I picked wool, and de ole woman spun. Me and another gal foteched all de water dat made de mortar for dat house. I've been through a good deal of hardship, but never got no beatin' about work; only when I was mischeevous and saasy, and dat was for want of puttin' to other practices. I had to be at somethin'!

"Once Uncle Tom told me ef I got some black rags and things, and fixed 'em on like wings, I could fly like a turkey-buzzard. I tried it, and I had a sweet fall, mind I tell ye! 'Nother time I clum up on de roof to 'tend to dryin' some water-million seed, and maaster like to have 'tended to me, only I talked him out of it. He said he wasn't goin' to let me teach de chil'n to break deir necks, and told me to come down and let him whip me.

"'Lor, maaster! sez I, 'I gwine up here to comb my head, and den I'll clean de knives and keep myself neat and tidy, and not let de meat get burnt;' and I talked to him

most as long as I been talking to ye here—but I didn't come down! De carpenters was workin' dere, and dey began to laugh, and den he laughed, and went into de house, and when I was sure he was gone I come down, and kep' out of his way. Den I used to get de scissors, and go into de garret and cut holes in de gowns; and once—den, ye mind, de saddles was all fringed—I cut all de fringes off de saddles. I was young, wild, and wicked! I didn't know no better! Mistuss told mother to whip me for dat. She did whip me, 'deed she did, heap harder dan mistuss! Mistuss never let any body tetch me but her and mother. Miss Betsy, she was housekeeper—a very tough woman, a rale yaller-jacket, I'll tell ye—she never let her tetch me!

"Great times den among de quality! Dressin' ain't quite so touchy now as it was den: silk, satin, brocade, lutestring, polaneese—yes! long polaneese and short polaneese and cassatees. O Lor', chile, dey did dress beautiful! De elegantest, beautifulest things come from England. Mistuss, when she took de dresses out de chist, dey stood up stiff as a table, or a piece of plank stuff. Great ostrien feathers, some red and some blue, and all colors; de ladies wore dem in deir rolls. Rolls—cushions dey was, with deir hair combed over dem—slick and powdered; den de ostrien feathers atop o' dat, and rows of beads acrost 'em, goin' through de rooms like little air castles! Ladies, and gentlemen too, powdered. De ladies wore long sacques and hoops—sich full dresses, flounced and tapered off; side hoops and round hoops, and high-heeled shoes, and sich little heels! Dey come from de ole countries—from England. Mistuss had great trunkful fatched home. Good calicoes for common, and *chinchies*, and silk and fur cloaks for winter.

"Gentlemen dressed elegant too. Beautiful silver-set buckles, glass and stone in 'em; goolden on de coats and waistcoats, flowered like ladies' dresses; and three-cocked hats, bound round with gold-lace; and long boots or gaiters when dey was a-horseback. Dey wore wigs, long wigs with queues, and short wigs without 'em. Tom C— wore a long wig. Deir coats was mostly blue, black, and drab, and nankeen for summer. Tell ye, chile, dey was fine! I was so took up with dem many a time I couldn't eat my vittels. Mother licked me often for not comin' to my dinner!

"People lived high—first chop! Grand dinner-parties dey raly had; danced till day in dat ole room dere. What! yah! yah! Hear de silks come rattlin' through de rooms dere like a passell of ole dry leaves. Dance till day! All dem people's dead and gone now!

"Dere was Captain L—, as pretty a dancer as need to be of mankind! He's taken many a drink of water out of de bucket on my head when he was haulin' in his wheat to mill. He used to drive de team hisself. He's dead now, ye know. And ole Stephen Shamydine! Sure God makes every body, but I do think he was de homeliest white man I ever saw. With his hairy bear-skin cap and rigimentals and sword. It's God's truth! And when his house was done, dey sent him a present of a big brass knocker fur de front-door, de elegantest knocker ever ye see; dat's for why dey named dat place Pomona, arter de imidge on de knocker, so dey tells me. Tom C—, as good a man as ever stepped de land, he lived with Dr. H—, little man, but like a piece of fire; elegant doctor, but as cross a man as ever drawed de bref of life; as impident a piece of goods as ever I see for a little man! And Major Howard! He went to de war arter, and got wounded. Ladies was very sorry for it, for he was de very apple of deir eye. I heard dem talk of it. He was at our house many a time. And Crack-brained Davy T—, a coarse-lookin' fellow, a hot-blood, fox-huntin', racin', sportin' character. It was so his mother nicknamed all dem chil'en—Crack-brained Davy, Gentleman Mordecai, Blackguard John, Extravagant Joshua, Miser Tom; and de girls was Whip-poor-will Betty and Butterfly Rachel. Mordecai was a pale, thin, blue-lookin' man, and Tom was as beautiful a dancer as could be, he was. You seen his pictur', with de murroon velvet and gilt buttons, and de sea compass in his hand! And Sam W—, he could beat any body dere a-makin' a bow, though he did dress in homespun. Den dere was Cornelius H—, the *surveeor*. He was a Methodist, but he was a very good man to his people; he didn't dance neither jigs, nor reels, nor court-lil-yows, nor minuets, nor fisher's hornpipes, nor nothin'! He was raly good to his people, and used to pay for any harm dey did, rather than whip dem. But L—'s was a whippin' house, G—'s was a whippin' house, K—'s was a whippin'



THE DANCE.

house—whippin' and cuttin' every Monday mornin' all over de neighborhood. Some had got deir maaster's horse and gone 'way out to Elk Ridge to a nigger dance; some for one thing, some for another, but gin-erally whip anyhow! Den dere was ole K——, a fox-huntin', racin' character. Didn't you never read his history on de tombstone at de church? I don't know from A to Izzard, but dey tells me dat somebody's wrote it so as it reads he was a darned rascal.

"Dat fox-huntin' made gay old times. Be up at two o'clock in de mornin': sich runnin', racin', ridin'! Maaster kep' deir company, but he didn't keep hounds. We niggers had our time too. Every Saturday night we had leave to go dance at de quarter, or at de barn in warm weather, and at Christmas and Whitsuntide and Easter we had a great frolic, we had. Sich dancin'! My Lord! plenty to eat and drink—meat, cabbage, turnips! Same thing at de huskin' matches—till dey got to fightin' and stobbin'."

"Nathan Cromwell's Pepin and Philpot's Jack and Worthington's Mingo was de

greatest fiddlers of de county. Dey used to go 'way down to 'Noppolis" (Annapolis). "Our Starling was a great fiddler. Mistuss let him go any where he choosed—never took no money from him—till one time he went to Baltimore to learn play *Hail Columby*, and he didn't come back for twenty years—den he staid. Blind Johnny and Club-foot Davy was white men and great fiddlers for de quality; colored people ketched a great deal from 'em. De great tunes den was *Bob and Joan*, *Dusty Miller*, *Jack ma Green*, and so on. Den dere was card-playin' and black-gamblin', and horse-racin' twice a year in Gist's fields.

'If ye will bet thousands, my gentlemen all,
I will bet millions on de famous skew-ball.
Spare us a venture on de courses of all,
I'm sure of winning on de famous skew-ball.'

Dat was a song dey used to sing. I can't sing now; I's got no teeth.

'I was drunk last night,
I was a little huddy—
Oh, plantation gals,
Can't ye look at a body!

Hi dompty, dompty,
Hi dompty, dompt!

My! don't talk! Didn't we jump in dem

days!

'Where did ye come from?
I come from Virginny.
Who's in de long-boat?
Simon and Caesar.'

Dem was de songs—sing and dance 'em too.
Den dere was a great song of dem days my
young missus used to sing:

'Dere's na luck about de house,
Dere's na luck at all;
Dis is de time to mind yer work,
While—'

Let's see—

'Dere's litle pleasure in our house
While our goodman's awa.'

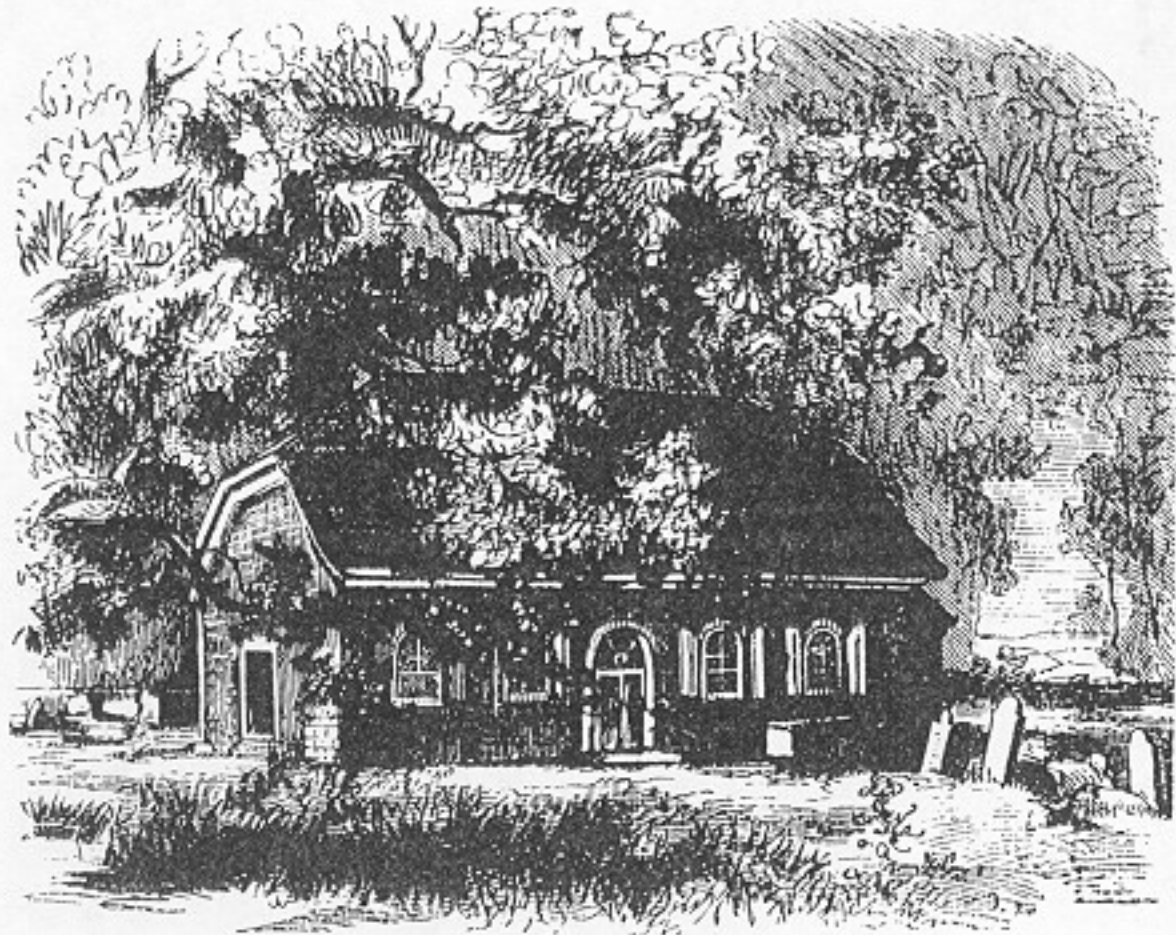
I can't 'xactly 'member it. Enoch Story used to sing it. He was de music-maaster, a little man, a furriner. He come up from town and used to teach missus's daughter to play de spinnet. No more spinnets now! Dey was made like a piano, with ivory teeth. I tell ye, I 'member it!"

The spinnet, or spinet, was a musical instrument of the harpsichord kind, but differing in shape and power; formerly much in use, though now entirely superseded by the piano-forte. The tone was comparatively weak, but pleasing, and as the instrument was small in dimensions and cheap in price, it answered the purpose of those who did not find it convenient to purchase a harpsichord.

"For women of quality dere was Miss Betsy X——; she had a tongue equal to any lawyer; a clinking tongue! and Miss Hannah W——, a sickly woman; she died o' consumption; and Nelly R——, Nick O——'s wife; and Hannah J——; she was a big, stout lady, with a brown skin; and Betsy R——; she was a good fortune; and Polly W——, Passon W——'s daughter. Ole John Tilly, who come from Jamaica or some furrin parts, courted her; she had head-piece enough, but her Maaster above called

for her, and she went home.

"Maaster's daughter, Miss Becky, was as pretty a woman as ever de sun shined on; counted de beautifulest woman in dem days for fair skin, pretty teeth. A genteel-made woman, of beautiful behavior—nuff to charm de heart of a stone! When she was married missus let me creep into de room, de back parlor dere. De gentlemen thought she was an angel from heaven, in a white satin dress, and white ostrien feathers in her rolls—feathers so tall she had to leave her shoes off till she come down stairs—and buckles with stones in her shoes! So busy, lookin' and cryin' together, nobody seed



ST. THOMAS'S CHURCH.

me; women a-cryin', and gentlemen tickled at it. It was de dreadfullest rainy night ever ye see. Passon Chase was fotched from town—a very handsome man; had some fringy thing on when he married dem; 'twas about seven or eight o'clock, by candle-light, in de old back parlor dere. De groom was in light clothes, and de grooms-men and all saluted de bride down de stairs.

Den dey went to dancin'; supped before de dance, and den handin' round between de dancin'. And at de supper dere was every thing

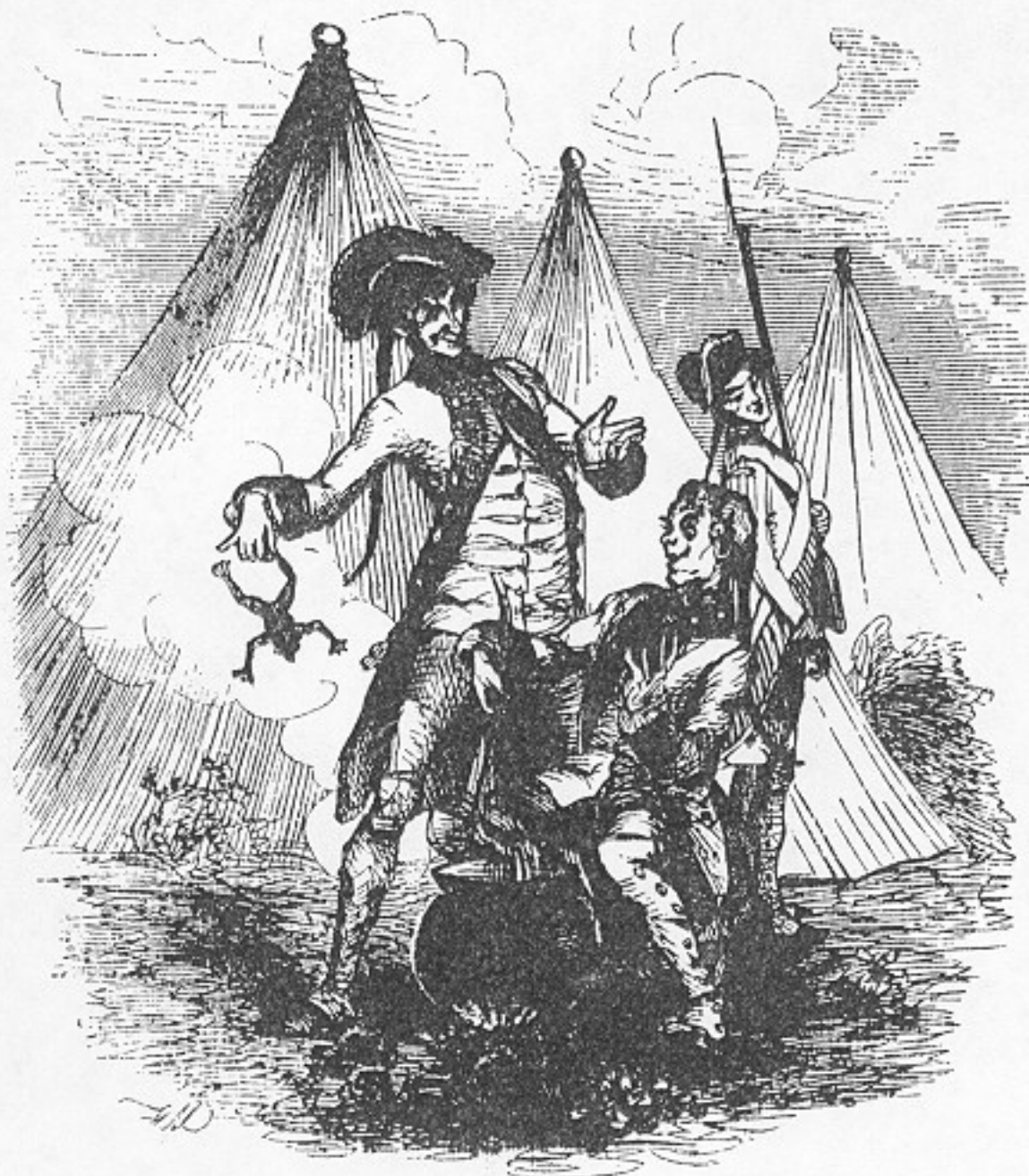
ye could desire—roast pig, chicken, turkey, ham, cherry-tarts, apple-tarts—screamin' time dey had, mind I tell ye! Oho! ha, ha! 'deed dey did dance dat night! dreadfullest rainy night ever I see! Stormy weddin', I tell ye. Afterward it took three weeks to get round de visitin', dinin', and dancin'.

"Captain L— was dere; Captain L—'s mother—no, she wasn't dere; she'd gone home to glory: a little bit of a Scotchwoman, de least woman I ever see; she wanted to be carried home to Ireland to be buried—a pretty piece of business! She was buried somewhere in town here 'mong de Presbyterians.

"Den dere was Betsy B— was dere, and her brother; both had red heads. She had some misfortin; dey fit a jewill about it, and she went away to England. And Dr. H— and Mistuss H—; she was as de Lord made her, but she was a very homely woman; Wylet H—, a jolly big woman, brown skin, monsus big; and Becky Plowman, she was raly a mere pictur', a very jolly-made lady, nice round-made lady, not so very tall. Most all dese people are buried in Garrison Forest church-yard.

"Every one of dem Y—s buried deir husbands. So much of dis eatin', drinkin', and feastin'! And when all's gone dese people turns round and says ye're so extravagant and wasteful. Dey be de very first people to talk! Ye may stand to it while ye live, but de chil'en come to want. Can't measure de snake till he's dead. Niggers and every thing else must go. Seen many a plantation lost so. Be neighborly, kind, and all dat; go to church; mind what I say, but mind what I do!

"A Sunday dey all went to Garrison For-



THE FRENCH CAMP.

est church, St. Thomas's, de great church of de county. Dey came from all around—Soldier's Delight, Chestnut Ridge, Randalls-town. Most people come a-horseback. Ladies were good riders den; dey wore gypsy hats tied under de chin. De road was full of people, mostly a-horseback, some in coaches and chaises. Tom C—'s father, de pason, he come from England—de biggest, fattest man ever I hear tell of. Took two or three men to lift him into de pulpit, till at de last he broke de axle-tree of de carriage, and he couldn't go no more. Why, dey took de fat out of him by de pound, Dr. H— did (monsus skillful man, Dr. H—!), and dey presarved it in liquor, and I b'lieve dey got it kep' to din day!

"When de war come—dat day, understand I tell ye—dere was a cannon (I's axed about dat cannon many a time) up at Captain L—'s store. I s'pec's it was advertised, but when dat cannon was fired, next day ye'd see de malishy, dey called dem, a-marchin' down from Pennsylvania

and about and de Lord knows whar, all kivered with dust, and dressed in brown linen huntin'-shirts, pleated and fringed, mostly farmers. Dere was enough to go. Dey cayed canteens and knapsacks, and dey had great hairy high caps—yes, dey had; s'pec's dey was bear-skin—and dey wore leggins. De officers was dressed in rigimentals, blue and red, with hairy caps, and a valise and canteen buckled behind deir saddles. Some wore linsey-woolsey gray bear-skin cloth. Dey used to sing,

'My cold feet! my cold hands!
My belly aches, but my pluck stands!'

"Never seed so many men, 'cept when de French army was here—as beautiful a sight as ever I see, so bloody-minded! De place was black with people when dey had deir review here. Dey come into town on a Sunday, and ye had to open yer house to take de head men in; de outskuffins went into tents in de fields. When de townspeople heerd dey was comin' dey thought it was de British, and sich runnin' and ridin' all day and night to get de wagons and horses to cay de goods out of de town! Dey liked Baltimore wonderful, de French did, and dey made a song dat dey would make New France of dis place. But deir was some of dem was very vulgar. Dey was de devil dat brought in dis eatin' of terapins and frogs and snakes here. De Lord sent enough here, without eatin' sich devilment as dat! Dey riz de market with deir cookin' and eatin'. It was dem foted in, too, dis callin' trowsers *pantaloons*, and stocks dey called *cravats*.

"In de time of de war dere was constant ridin' with papers, back and for'ard, night and day. See a gentleman ride up to de door, give de papers to maaster, and ride off; never get off de horse, never 'light!

'Now I'm a-comin' with all de week's news,
Some lies, and some true.'

Dat's what old John White used to sing when he come and used to chase us all over de place. When I hears him I runs under de platform, he after me, here, dere, every where. He was a monsus big man. Oh, my Lord! And mistuss—she was monsus big woman—used to most bust laughin'! Sich runnin' and hollerin' to try and skere us chil'en! Christmas he brought de Bell snickle. Once he asked me for a drink of water, and while he was drinkin' I pitched

de bucketful all over him. Didn't I put den!

"Mistuss and Miss Betsy and old Sally B—— (she was a widow woman) and 'Good Liddy'—she was a good crittur dat mistuss raised—dey helped to make huntin'-shirts for de army, and we sarvants was all kept busy a-sewin' and knittin' and spinnin'. Sence, bringin' in dem factories broke de spinnin'-wheels. We made one hundred shirts for Lafayette's army. Every thing went for de war. Dey used to go into yer fields and press de fattest cattle, and yer wagon, when dey wrote on it it was for de army, and yer load of hay too! Dey cayed all along. De soldiers looked like de ruffins ye see on de streets. Dey used to take a man from his plow in de field, wife and chil'en a-cryin', de soldiers a-cussin' de women, and marchin' off de husband before 'em. Stephen Shamydine and Maaster David Poe used to press. Captain L—— and Major Howard went, and even Tom C—— had to go. Nuff had to go; heap of cryin' about it! Maaster gave a man a lot of money to go his *substitute*, dey called it: man never come back, and never was heard of no more!

"Well, dere was dis everlastin' flyin' of papers until dey 'claim peace; and we was glad enough when it come. And soon arter dat old maaster died wid de gout. He was dat cross nobody could come near him 'cept me and another boy. Maaster was 'dustrious man, and used to stand up to de huskin' pile like any one of us.

"I lived twenty-three year on dat plantation arter maaster died. When ole mistuss died she left me to go clear for myself—Aunt Liddy, cook Liddy, Henry, me, and Carlos; left all my chil'en free 'cept two—I had fifteen chil'en, but don't ye see I look gamesome yet! De last was born time of Ross's war. We were up at Green Spring den; hear de guns roarin' at Fort M'Henry, mistuss and young mistuss a-frettin' and cryin'. Soon arter mistuss took sick and died.

"I staid a year and two or three months arter I was free, caise I knowed nothin' of hirin'. But now I'd got de string off my neck, I thought it was time for me to leave to do somethin' for myself, so I comes down to Baltimore once, all unbeknowns to my mistuss; and caise I didn't go to tell her she was mad, and said she didn't care if I staid or no. Dat 'fronted me, and I says

to myself, I'll change my name to 'Peter' and put out; so I called myself 'Peter Put-out.' Eve was my name.

"When mistuss heard I was raly goin', she comes out of de house, and says she, 'Eve, yer maaster says he'll build ye a house if ye'll stay.' But it was too late. I'd asked him before, and he wouldn't, so now I was bound to go. I was so choked up and so full, I couldn't say nothin'; it was like life and death was partin'. Home is the best place, be it ever so homely. I was faithful to 'em. I was allers ready, never was afraid to work. I'd go out any hour of de night, when I heerd de rain and de storm, and take de lantern and go 'way down to de milk-house all by myself, and take de milk out and put de pans under

de big oak-tree, and fotch rocks to put on 'em; water a-risin', and de great black water-snakes a-lyin' dere glisterin' in de dark; sometimes I had to take a horse to go to 'em, de water riz so high often.

"Mistuss cried after I went away: hasty and passionable, but clever woman. Never been dere but once or twice sence.

"Lamps was lit when I got to town, and next day I hired myself to a man named Jimmy French, 'way up de country. I went one Saturday and staid till Thursday. He said he never seed any body do as much work as I did; but dere was no black people dere, and it was monsus lonesome—no body to speak to—and I didn't like it. So when I heerd dere was to be a launch in Baltimore I told him I was goin' down to



WASHINGTON AND HIS SERVANT.

see it, and I raly did mean to go back; but as I was gwine along a man let me ride in his cart, and arter I'd rid a while I see so many blue rocks and high grass, says I, 'Here is rocks and here is grass; must be great many snakes about here.' Says he, 'We throws 'em out twenty foot long with our scythes in de spring.' 'My God!' says I, 'I never come out here no more!' and I've never been dere no more from dat day to dis. When I got to town I forgot all about de launch, a-thinkin' of de snakes and de wildernesses. But I called myself Peter, and I soon got work. Washin' and cookin', cleanin' and scourin', dat was my trade. Nice woman took me and gave me four dollars a month, every Christmas five dollars. I worked hard, and I put all de money I saved in de bank, till I got my chil'en all

free—Ben and his wife and child, and my daughter Fanny. I gave seventy dollars for Ben and Fanny, and one hundred and fifty dollars for wife and child. My husband Bill, if he'd 'a had pluck, might 'a bought Ben for twenty dollars before he left de (Garrison) Forest, but he was married to de whisky-bottle. Sonny, you got very pretty foot, mighty pretty features. I'm a poor old crittur, but I must talk lively to keep my sperits up. If I jest had some-thin' to buy my tobacky.

"Yes, Sir, I did see Washington once walk-in' with his black sarvant. He was a good-lookin' man in black clothes. Can't hold up to him in dis day. He protected de land and made it all stanch. Dat's his imidge on his ornamant dere."

HARPER'S NEW MONTHLY MAGAZINE — JUNE, 1864

THE POOR WHITES OF THE SOUTH

PROFESSOR CAIRNES, of Dublin, in his very valuable and generally accurate work on the "Slave Power," says:

"In the Southern States no less than five millions of human beings are now said to exist in a condition little removed from savage life, eking out a wretched subsistence by hunting, by fishing, by hiring themselves out for occasional jobs, and by plunder. Combining the restlessness and contempt for regular industry peculiar to the savage, with the vices of the *prolétaire* of civilized communities, these people make up a class at once degraded and dangerous; and constantly reinforced, as they are, by all that is idle, worthless, and lawless among the population of the neighboring States, form an inexhaustible preserve of ruffianism, ready at hand for all the worst purposes of Southern ambition. . . . Such are the 'mean whites' or 'white trash'. . . . This class comprises, as I have said, five millions of human beings—about seven-tenths of the whole white population of the South."

This opinion of Professor Cairnes is no doubt shared by a large portion of the people of the Northern States and of England. But it is a great error. Having read of, or seen, the wretched specimens of humanity who loiter about the railway stations, or hover around the large plantations on the great Southern thoroughfares, they have inferred that they represent "seven-tenths of the whole white population" of the South! The idea is preposterous, for, if it were true, one half of the Southern people would be paupers, while no community could support that proportion of non-producers. But it is not true. The great mass of "poor whites" are superior (and I say this with due deliberation, and after

sixteen years' acquaintance with them) to any other class of uncultivated men, save our Northern farmers, on the globe.

The eight millions of Southern whites may be divided into three general classes:

First, *The ruling class*, which includes the planters, and the higher grades of professional men, and numbers about one million. Second, *The middle or laboring class*, which includes the small traders, mechanics, farmers, and farm and other laborers, and numbers about six and a half millions; and, third, *The mean white class*, which includes all who are appropriately called "poor trash," who glean a sorry subsistence from hunting, fishing, and poaching on the grounds of the planters. This class numbers about half a million, and to it only does Professor Cairnes's description apply.

The two latter classes are of very marked and decidedly opposite characteristics. One labors; is industrious, hardy, enterprising; a law-abiding and useful citizen: the other does not labor; is thieving, vicious, law-breaking, and of "no sort of account" to his family or to society.

The mean whites do combine "the restlessness and contempt for regular industry peculiar to the savage, with the vices of the *prolétaire* of civilized communities." Their houses are often the pole wigwams of the Indian, shaped like a sugar-loaf, with merely a hole at the top to let the smoke out and the rain in; but generally they are small huts of rough logs, through the

crevices of which the wind in winter whistles a most melancholy tune. The one room of these huts is floored with nothing but the ground—hardened with mauls, and hollowed at the centre, as if to hold the rain that comes in at the roof—and it is furnished with a few rickety chairs, a pine log—hewn smooth on the upper side, and made to serve as a sofa—a cracked skillet, a dirty frying-pan, an old-fashioned rifle, two or three sleepy dogs, and a baker's dozen of half-clad children, with skins and hair colored like a tallow-candle dipped in tobacco-juice. In one corner there may be a mud oven, half crumbled back to its original earth, and in the others, two or three low beds, with corn-shuck mattresses and tattered furnishings. The character of the inmates is suited to their surroundings. They are given to whisky-drinking, snuff-dipping, clay-eating, and all manner of social vices.

The costume of these people is of the most meagre and mean description. The women go with bare heads and feet, and their only garment is a coarse cottonade gown, falling straight from the neck to just below the knees. The men wear slouched hats, and linsey trowsers, and hunting shirts, so begrimed with filth, and so torn and patched in a thousand places, that scarcely a vestige of the original material is left visible to the naked eye. Many of them—owing, no doubt, to their custom of intermarrying—are deformed and apparently idiotic, and they all have stunted, ague-distorted frames, dull, heavy eyes, saffron-hued skins, small, bullet-shaped heads, and coarse, wiry hair, which looks like oakum shreds bound into mops and dyed with lampblack.

They answer, in their general characteristics, to the "scum" of our Northern cities, and to the vile denizens of the back slums of London and other large European towns; but it may be questioned whether there is any where a class of whites quite so degraded and so utterly useless as they are. Every where but in the Slave States the poor man labors, produces something toward the support of himself and of others, but the "mean white" of the South does not know how to labor; he produces nothing; he is a fungous growth on the body of society, absorbing the life and strength of the other parts.

As I have said, the laboring poor whites are a very different people. They comprise fully three-fourths of the free population of the South. The census shows that on the first of June, 1860, there were in the fourteen Slave States, exclusive of Delaware, 1,359,655 white males engaged in agricultural and other outdoor employments.

Of this number, 901,102 are classed as "farmers"—men who till their own land: 230,146 are classed as "farm-laborers"—men who till the land of others: and 228,407 are classed as "laborers"—men engaged in outdoor work other than the tillage of land. The "farmers" are not to be confounded with the planters—men who work large tracts of land and large bodies of slaves, but do not work themselves—for the census takes distinct account of the latter. They number only 85,558, but—such has been the working of the peculiar institution—they own nearly three-fourths of the negroes and landed property of the South. These one million three hundred and odd thousand laboring white men represent a population of about six millions; and if we add to them the four hundred thousand represented by the planters, and the one million represented by men in trade, manufactures, and the professions, there can hardly remain, in a total population of less than eight millions, "five millions of human being who eke out a wretched subsistence by hunting, by fishing, by hiring themselves out for occasional jobs, and by plunder." Half a million—the number I have stated—is vastly nearer the truth.

Little is known at the North of this large farming population, for the reason that they live remote from the great thoroughfares, and have been seldom seen by travelers. They are settled generally in the "up-country" and "backwoods," and there lead industrious and plodding lives. From them have sprung such men as Patrick Henry, Thomas Jefferson, Andrew Jackson, John C. Calhoun, Henry Clay, Alexander H. Stephens, Andrew Johnson, Parson Brownlow, President Lincoln, and nearly all the representative men of the Slave States. In fact they are the bone and sinew of the South, the strength of its armies, the men who are now so patiently fighting and enduring in the cause of Secession; and they will be, when the Union is restored, the ruling class, the real political South of the future.

To illustrate the habits and characteristics of the farmer class of "poor whites"—(this name is a misnomer, for a man can hardly be called "poor" who owns his own house and farm, and enjoys all the necessities and many of the luxuries of life)—I will introduce to the reader one of its representative men, whom I met at his home in Tennessee, about thirteen years ago, and again encountered at Murfreesboro, in the month of May, 1863; and I will let him "speak for himself," in his vernacular dialect, as I may thereby give a more correct idea of the peculiarities of his class than by a more general descrip-

tion.

Late in November, 1850, while journeying on horseback from Tuscaloosa, Alabama, to Louisville, Kentucky, I was overtaken by a storm one day, just at nightfall, and forced to ask shelter at a small farm-house near the little town of Richmond, in Bedford County, Tennessee. The house stood in a small clearing a short distance from the highway, and was one story high, of hewn logs nicely chinked and whitewashed, with a projecting roof, a broad, open piazza, and an enormous brick chimney-stack protruding at either gable. As I rode up to it the farmer came out to meet me. He was dressed in homespun, and had a wiry, athletic frame; a dark, sun-browned complexion; an open, manly face; and a frank, cordial manner that won my confidence in a moment. He bade me "good evenin'" as I approached him, and returning his salutation, I asked him for shelter for myself and horse.

"Sartin, Stranger," he replied; "I niver turned away one o' God's images yit, ef they wus a Yankee—an' some o' them is drefful pore likenesses, ye mought bet a pile on thet."

"Why do you think I am a Yankee?" I asked, smiling.

"I sees it all over ye. But come, alight; ye's welcome ter all I hes, an' ef ye kin spin a yarn or tell a lie ony bigger'n I kin, I'll 'low a Yankee ar smarter'n a Tennessean—an' I niver know'd one as war yit."

Dismounting, I requested him to give my horse some oats, remarking that I made free with him, because I expected to pay for what I had.

"Pay!" he exclaimed; "niver ye tork uv pay, Stranger, 'tween two sich men as ye an' me is, or ye'll make me fight another duel. It's agin my principles, but I fit one onst, an' it mought be ye wouldn't loike ter hev me fit another."

"Not with me, I assure you. I'd take free quarters with you for a month rather than fight a duel."

"Yer a sensible man; fur I shud, fur shore, sarve ye jest as I done Clingman—thet famous North Car'lina chap. P'raps ye niver yered how I fit him?"

"No, I never did."

"Wall, I'll tell ye on it. But yere, Jake" (to a stout, cheerful negro, who just then appeared at the corner of the house)—"yere, Jake, tuck the gen'leman's nag, rub him down, an' guv him some oats, an' mind, doan't ye guv no parson's measure wuth the oats."

"Nuver you far, Massa. Jake'll gub it ter 'im chock-heapin'—loike you gub's ebery ting,

Massa," rejoined the negro, bounding nimbly into the saddle, and riding off to the barn-yard.

The farmer then turned and led the way into the house. At the door of the sitting-room we were met by his wife—a comely, dark-eyed woman of about thirty, neatly clad in a calico gown, and a spotless lace cap perching cozily on the back of her head.

"Sally," said my host, as we entered the room, "yere'r a stranger; so tuck him in; guv him fritters an' apple-jack fur supper, fur he'm a Yankee, an' thar's no tellin' but ye mought save the kentry ef ye made him fall in love wuth ye."

The good woman laughed, gave me a cordial greeting, asked me to a seat by the fire, and went about preparing supper. As I seated myself with her husband by the broad hearth-stone I glanced around the apartment. It occupied one half of the building, and had a most cozy and comfortable appearance. On the floor was a tidy rag carpet, and the plastered walls were covered with a modest paper, and ornamented with a half dozen neatly-framed engravings. A gilded looking-glass, festooned with sprigs of evergreen, hung between the front windows, and opposite to it stood a huge piece of mahogany, half a side-board, half a bureau, which in its day had graced some statelier mansion. A dozen rustic arm-chairs, covered with untanned deer-skin, a small stand in the corner piled high with such books as the Bible, the "Pilgrim's Progress," and "Doddridge's Expositor," and a large pine table, on which my hostess was arranging the tea-things, completed the furniture of the room. A little boy of five and a little girl of seven were helping the good-wife set the tea-table, and through an open door at the rear I saw an older child, with her mother's dark-brown hair and her father's expressive features, busily frying the fritters over the kitchen fire.

After asking me where I "come from," where I "mought be meseyn' ter," and other similar questions, my host said:

"So ye niver yered how I fit Clingman—thet big Whig chap over thar ter North Car'lina?"

"No," I replied, "I never did, but I would like to, for I know Clingman."

"Wall, ye sees, it war jest afore the last 'lection, when ye put in ole Zack fur President. The Whigs they had a big barbecue down ter Richmond, an' Clingman an' a hull lot uv 'em went inter speechifying ter kill. Wall, in the coorse uv Clingman's speech he said thet Cass, our canderdate, wus a nigger-trader down thar ter Newbern way, an' wus in jail fur passin'

counterfit money, an' ef we 'lected him, we'd hev ter bail him out ter 'nauerate him. Now, I couldn't stand thet, no how, so I telled Clingman he lied loike blazes. Wall, he stopped short ter oust, an' axed me fur my redress."

"Address," said his wife, pausing in her work, and looking pleasantly at me.

"Thet's so, Sally," replied the farmer. "Stranger, Sally hes all the larnin' uv the fambly. She's a quality 'ooman—she is! Wall, I guv Clingman my name, an' whar I hung out, an', shore 'nuff, jest arter dark, a feller rid up yere wuth a challenge, all writ out in Clingman's own hand—an' ye knows he's a right smart scholar, an' a durned clever feller ter boot, ef he ar a Whig. I couldn't read the thing—I hain't got no funder nur prent yit—so I guv it ter Sally. Sally she 'screeched out when she seed whot it war 'bout, but I telled har ter stand up, an' die loike a man, an' so she sot down, an' 'cepted the challenge. Now, ye knows, the challenged 'un allers hes the chise o' weapons, so I said I'd hev swords, mounted."

"Then you are familiar with sword practice?" I remarked.

"Furmilye wuth it! I niver seed more'n one sword in all my borned days, an' thet war so durned rusty a ox-team couldn't dror it. It hung over dad's front door when I war a young 'un. Dad said he fit wuth it ter Cowpens, but I know'd he didn't, 'case he couldn't ha' been more'n two y'ar old at thet writin'.

"Wall, I said swords, mounted, at sun-up the next mornin', over agin my r'ar pinery. Now, I hes a drefful smart ox-brute thet I'se a raised up fur my privat' ridin'. The brute he doan't loike a spur, an' when ye puts one inter 'im, he'll pitch, head-foremose, inter the fust thing he comes ter, be it man or beast. Wall, in the mornin' I tuck out the cow-horn (ye'd think Gabriel war a soundin' the last trump when I blows it), cut a right smart stick fur a sword, put it inter a yaller bag thet lucked loike a scabbard, got out the ox-brute, tied a red rag ter his horns, put on him my wife's best kiverlet—Sally hed it agin we got morried; it hes more colors nur Joseph's coat, but red an' yaller dominates. Wall, I put on the kiverlet fur a saddle, an' moseyed off ter the dueling ground.

"Clingman, he war thar, wuth two seconds, a doctor, an' a hull 'pothecary store uv cuttin' instruments, all waitin' an' ready ter mako mince-meat uv my carcass. Soon as he seed how I war 'countered, he up an' 'jected ter fightin', but I counted out the terms uv the duel—swords, mounted—an' I telled him ef he didn't stand an' fight loike a man I'd post him all

over the State o' North Car'lina fur a coward. Wall, finarly he 'cluded ter do it. So, we tuck our stands, the seconds they guv the word, Clingman he put spurs inter his hoss, an' I put spurs inter mine, an', Stranger, ye'd better b'lieve when my ox moseyed down onter his mar, wuth horn a blowin', an' kiverlet a flyin', the mar she piked out quicker'n a whirlygust chasin' a streak o' lightnin', an' she niver helt up till she got clean inter North Car'lina. I'se allers telled Sally sense thet thet kiverlet ar the flag I means ter live under, ter sleep under, an' ter die under."*

When I had somewhat recovered from the immoderate fit of laughter which expressed my appreciation of the farmer's story, his comely wife said to me:

"Fotch up yer cheer, Stranger. We hain't nothin' 'cept common doin's, but we's 'nuff o' them."

And there was "'nuff o' them." The table was loaded down with bacon, venison, wild-fowl, hominy, corn-pone, fritters, tea, cider, and apple-jack, all heaped upon it in promiscuous confusion. I had ridden far, and eaten nothing since the morning, but I might have relished the viands had my appetite been much daintier than it was.

A desultory conversation followed till the close of the meal. When it was over, again seating myself with the farmer before the blazing light-wood fire, while his wife and elder daughter went about clearing away the tea-things, I said to him:

"Now I want to ask you how you live, what you raise, how many negroes you have—all about yourself, for I've already fallen in love with you and your wife."

"Fall'n in love wuth me! ha! ha!" echoed the farmer. "Stranger, I niver fell in love wuth nary man 'cept Sally, but I fell inter it so deep wuth she thet I'se willin' all creation shud love har jest loike I does—an' they wud, ef they only know'd har so wall as me."

"I have no doubt of it. Does she do all her own housework?"

"Uvery thing—she an' the little gal. She woan't hev no lazy nigger wimmin round. They make more wuck nur they does."

"Do yer wife wuck, Stranger?" asked the lady. "They say wimmin all wucks ter the North."

"Nearly all do—except my wife. She don't, because I have none. But I intend to have one. I shall probably wait till your husband breaks

* Subsequent inquiry satisfied me that the farmer's account of this singular duel was substantially true.

his neck, and then pop the question to you."

"Wall, I reckon I'd hev ye, fur I'se sort o' tuck ter ye. 'Pears loike ye Northern gentlemen hain't stuck up, an' doan't 'count tharselves no better nur wuckin' folk, like the 'ristocracts does round yere."

"The heart, not the wealth or the intellect, Madam, makes the true aristocracy," I replied, gravely.

"Thet's whot our parson sez; an' in heaven, he sez, them as gits the highest hes hearts jest loike little childerin'—thet loves uvery thing, an' uvery body, an' hain't no larnin' at all. Ef thet's so, Bible'll be one on the biggest on 'em, fur he's got nigh ter no larnin'—he kin only jest make out ter spell—an' his heart ar big 'nuff ter holt all o' creation."

"Doan't ye say thet, Sally," said the farmer looking at his wife with a tender light in his eyes, and a beautiful smile on his rough features: "The Lord moughtn't be uv yer 'pinion."

"Yas, He ar, fur He knows ye jest loike I does."

The farmer made no reply, and a short silence followed. I broke it by saying:

"Come, Bible, if that is your name, answer my questions—tell me all about yourself."

"Thet hain't my name, Stranger, though it'r whot I goes by. Ye sees my name ar Smith, an' dad chrisund me Jehoshaphat*—ter 'stinguish me frum the t'other Smiths, but, somehow, it got shortened ter Bible, an' it'r been Bible unter this day. I wuck'd 'long uv dad till I war twenty-one, for the ole 'un he said he'd a fotched me up when I war a young 'un, an' he war bound ter git his pay out o' me agin I war grow'd, an' he done it.

"Wall, the day I war uv age dad axed me out ter the barn, an' totin' out a mule-brute as hed been in the fambly uver sense Adam warn't no higher'n liddle Sally, he sez ter me, sez he: 'Thar, Bible, thar's my last wull an' testamunt; tuck it, an' gwo an' seek yer fortun'.' I hadn't nary chise, so I tuck the mule-brute an' moseyed out ter seek my fortun'. I squatted down right squar onter this dead'nin', hired my nig Jake (I owns him now), an' me, an' Jake, an' the mule-brute went ter wuck loike blazes—all but the mule-brute—he war too tarnal lazy ter wuck; he war so lazy I hed ter git my ox ter holp him dror his last breath. Wall, Jake an' me added acre ter acre, an' mule-brute ter mule-brute, as the Scriptur' sez, till finarly I got ter

be right wall forehanded. Then, one day, I sez ter Jake: 'Jake,' sez I, 'ye's got a wife, an' ye knows whot durmestic furlicity is—ter be shore ye hes ter keep it seven mile away; but whot's thet when I guvs ye Saturday arternoons an' Sundays all ter yerself. Now I hain't nary furlicity at all. Whot shill I do?'

"'Git a wife, Massa,' sez Jake; 'git a wife, Massa. Saddle de mar, Massa, an' gwo out on a 'splorin' expedition. Jake'll luck arter de fixin's while you'm away.'

"Now thet nig ar allers right; he's got a head longer'n the moral law; so I saddled the mar an' sallied out arter Sally. I hed ter scour nigh 'bout all o' creation, an' it tuck me four hull months ter do it, but—I found har. Soon as I sot eyes on har I know'd it war she, an' I telled har so; but she say, 'Ye must ax Par.' (Sally hes book-breedin', ye sees, so she sez *par* instead o' *dad*, which ar the nat'ral way.) Wall, I axed 'par;' he's one on yer quality folk, been ter Congress, an' only missed bein' Guv'ner by—not gittin' the nomurnation. I axed him, an' he shuck his head; but I guv him jest a week ter think on it, an' moseyed out ter git ready agin the weddin'. I know'd he'd come round, an' he done it. So I sez ter Sally: 'Sally,' sez I, 'we'll be morried ter-morrer.'

"'Ter-morrer!' screeched Sally, holtin' up har hands an' openin' har eyes; 'why, I hain't a ready I hain't no cloes!'

"'Cloes!' sez I; 'nuver mind yer cloes; I doan't morry ye fur them.'

"So Sally she consented, an' I piked out fur a parson. Now thar warn't none nigher'n over a branch, an' it so happin'd it rained loike blazes thet night, an' toted off all the bridges; so when the parson an' me got down ter the run jest arter noon the next day—we wus ter a been morried at 'levin—thar warn't no way o' crossin'; but thar war Sally, on the t'other side uv the run, in har sun-bunnet an' a big umbrell', onpatiently waitin' fur us. Thar warn't no other how, so I sez ter the parson: 'Parson,' sez I, 'say over the Prayer-book—Sally's got the hull uv it by heart agin this time—we'll be morried ter onst right yere.' So the parson he said over the Prayer-book, Sally she made the 'sponses—all 'bout the 'beyin' an' so on—an' we's been man an' wife uver sense; an' Stranger, I doan't keer whar the t'other 'ooman ar', thar hain't nary one livin' quite up ter Sally."

"An' does ye b'lieve thet story, Stranger?" asked Sally, who, having finished clearing away the tea-things, had, with the older daughter and the younger children, taken a seat near me in the chimney-corner.

* His name according to the army rolls is WILLIAM J. SMITH.

"I can't say that I do. Not altogether," I replied.

"I'm glad on it; fur we wus morried in a house, loike Christun people—we wus."

"Is Jake your only slave?" I asked the farmer after a while.

"Yas," he'r my only 'un, but he's as good as ony two ye uver know'd on. Ye sees, I raises nigh on ter no craps 'cept mule-brutes an' horned critters, an' them; ye knows, browse in the woods, and doan't make much wuck."

If space allowed I would tell the reader more of this farmer's family; how every thing about the house and outbuildings was the model of neatness; how the comely housewife strove, with grace and cheerfulness, to do honor to a stranger guest; how tidily she kept her handsome brood, all clad in homespun of her own weaving, and her own making; how the younger children climbed their father's knee, pulled his beard, and laughed at his stories, as if they had never heard them before; how nimbly the elder daughter sprang to do her mother's bidding, how she fetched the apples from the loft, and the apple-jack from the pantry, and, between times, helped to lull the sleepy little ones to sleep, or to keep them, wakeful, out of mischief; how when we parted for the night, Sally read a chapter from the big Bible, and then, all kneeling down, made such a prayer as the Good All-Father loves to hear; how when I bade them "good-by" in the morning all had to kiss me, from the mother to the youngest; and how Bible, giving me a parting grasp of the hand, said as I mounted to ride away,

"Come out an' settle yere, Stranger; we'll send ye ter Congress—the man as hes cheek enuff ter kiss a man's wife afore his vury face kin git ony office in this part o' the kentry!"

For nearly thirteen years I saw nothing of my Tennessee friend; but one day, last spring, as I alighted from the cars at Murfreesboro, a heavy hand was laid on my shoulder, and a strangely familiar voice accosted me with,

"I know'd it wus ye. I know'd ye the minnit I sot eyes on ye."

Turning on the speaker I saw a spare, squarely-built, loose-jointed man, above six feet high, with a strongly-marked face, a long, grizzly beard, and silvery black hair hanging loosely over his shoulders like a woman's. He wore an officer's undress coat, and the boots of the cavalry service, but the rest of his costume was of the common "butternut" homespun. Taking his extended hand, and trying hard to recall his features, I said to him:

"I know your voice, but I don't remember your face."

"Doan't remember me! me, Bible—Bible Smith! Why I'd a know'd ye ef yer face hed been blacker'n yer Whig principles."

The name brought him to my remembrance. Again grasping his hand, and shaking it this time with a right good-will, I exclaimed:

"I'm delighted to see you, Bible; and to see you *here*—true to the old flag."

"Ye mought hev know'd thet."

He accompanied me to my lodgings, and there, seated on the piazza after dinner, told me the story of his life since we parted. As it illustrates traits of character which are common to all of his class, I will give it, in part, to the reader.

The world had gone well with him till the breaking out of the rebellion. That event found him the owner of fifteen likely negroes, a fine plantation of nine hundred and thirty acres, and a comfortable framed dwelling and outbuildings. His elder daughter had married a young farmer of the district, and his younger—little Sally, whom I remembered as a rosy-cheeked, meek-eyed wee thing of only seven years—had grown up a woman.

In the spring of 1861, when there were no Union troops south of the Ohio, and the secession fever was raging furiously all over his county, he organized one hundred and six of his neighbors into a company of Home Guards, and was elected their captain. They were pledged to resist all attacks on the person or property of any of their number, and met frequently in the woods in the vicinity of their homes. This organization secured Bible safety and free expression of opinion till long after Tennessee went out of the Union. In fact, he felt so secure that, in 1862—a year after the State seceded—under the protection of his band of Home Guards he inaugurated and carried through a celebration of the Fourth of July at Richmond, Tennessee, under the very guns of a rebel regiment then forming in the town.

An act of so much temerity naturally attracted the attention of the Confederate authorities, and not long afterward he was roused from his bed one morning before daybreak by three hundred armed men, who told him that he was a prisoner, and that all his property was confiscated to the Government. They at once enforced the "confiscation act;" "and this," he said, taking from his wallet a piece of soiled paper, "ar' whot I hed ter 'tribute ter the ding-nation consarn. It'r Sally's own handwrite, an' I knows ye loikes har, so, ye kin hev it, fur it'll

nuver be uv no manner uv account ter me."

The schedule is now before me, and I copy it *verbatim*: "14 men and wimmin" [Jake eluded the soldiers and escaped to the woods], "1600 barrils corn, 130 sheeps, 700 bushls wheat, 440 barley, 100 rye, 27 mules, 5 cow-brutes, 105 head hogs, 17 horses and mars, and all they cud tote beside."

"Wall, they tied me, hand an' fut," he continued; "an' toted me off ter the Military Commission sittin' ter Chattanooga. I know'd whot thet meant—a short prayer, a long rope, an' a break-down danced on the top o' nothin'. Better men nur me hed gone thet way ter the Kingdom—sevin on 'em wuth in a month—but I detarmined I wouldn't go ef I could help it; not thet I 'jected ter the journey, only ter goin' afore uv Sally. Ye sees, I hedn't been nigh so good a man as I'd orter be, an' I reckoned Sally—who, ye knows, ar the best 'ooman thet uver lived—I reckoned she, ef she got thar a leetle afore o' me, could sort o' put in a good word wuth the Lord, an' git Him ter shot His eyes ter a heap o' my doin's; an' sides, I know'd I should feel a mighty strange loike up thar without har. Wall, I detarmined not ter go, so thet night, as we war camped out on the ground, I slid the coil, stole a nag, an' moseyed off. Howsumuver, I hedn't got more'n a hun'ed rods 'fore the durned Secesh yered me, an' the bullets fell round me thicker'n tar in January. They hit the hoss, winged me a trifle, an' in less nur ten minnits, hed me tighter'n uver. They swore a streak uv blue brimstun', an' said they'd string me up ter onst, but I telled 'em they wouldn't, 'case I know'd I war a gwine ter live ter help do thet ar' same turn fur Jeff Davis. Wall, I s'pose my impudence hed suthin' ter do wuth it, fur they didn't hang me—ye mought know thet, fur, ye sees, I hes a good neck fur stretchin' yit.

"Wall, we got ter Chattanooga jest arter noon. The Commission they hed too many on hand thet day ter 'tend ter my case, an' the jail wus chock-heapin', so they put me inter a tent under guard uv a hull Georgy regiment. Wall, I didn't know whot ter do, but thinkin' the Lord did, I kneeled down an' prayed right smart. I telled Him I hedn't no face ter meet Him afore I'd a done suthin' fur the kentry, an' thet Sally's heart would be clean broke ef I went afore har, but, howsumuver, I said, He know'd best, an' ef it war His will, I hed jest nothin' ter say agin it. Thet's all I said, but I said it over an' over, a heap o' times, an' it war right dark when I got off uv my knees. The Lord yered me, thet's sartin, 'case I hedn't more'n got up fore a dirty

gray-back, drunker'n a member uv Congress, staggered inter the tent. I reckon he thort he war ter home, fur he drapped down onter the ground an' went ter sleep wuthout so much as axin' ef I wus willin'.

"Then it come inter my head, all ter onst, whot ter do. Ye sees, the critters hed tied me hand an' fut an' teddered me wuth a coil ter one o' the tent-stakes, so I couldn't move only jest so fur; but the Lord He made the drunken feller lop down jest inside uv reachin'. Wall, when I war shore he war dead asleep, I rolled over thar, drawed out the bowie-knife in his belt wuth my teeth an' sawed off my wristlets in no time. Ye kin reckon it didn't take long ter undo the 'tother coils, an' ter 'propriate his weapons, tie 'im hand an' fut loike I war, strip off his coat, put mine onter 'im, swap hats, an' pull the one I guv him down onter his eyes loike as ef he nuver wanted ter see the sun agin. When I'd a done thet, I stopped ter breathe, an' luckin' up I seed a light a comin'. I 'spicioned it war ter 'xamine arter me, so I slunk down inter a crack o' the tent jest aside the door. They wus a leftenant an' three privits makin' the rounds, an' the light showed me nigh onter a army uv sentinels all about thar. Thet warn't no way encouragin', but sez I ter myself: 'Bible,' sez I, 'be cool an' outdacious an' ye'll git out o' this yit;' so when the leftenant luck'd in, an' sayin', 'All right,' put out agin, I riz up an' jined the fellers as wus a follerin' on him. I kept in the shadder, an' they, s'posin' I war one on 'em, tuck no kind uv notice uv me. We'd luck'd arter three or four pore prisoners loike I war, when I thort I'd better be a moseyin', so I drapped ahind an' arter a while dodged out beyont the second line o' pickets. I'd got nigh onter a patch uv woods half a mile off, when all ter onst a feller sprung up from a clump uv bushes, yelled 'Halt!' an' pinted his musket stret at me. I mought hev eended 'im, but I reckoned others wus nigh, an' sides, I nuver takes humin life ef I kin help it; so I sez ter 'im: 'Why, Lord bless me, cumrad', I didn't seed ye.' 'I s'pose ye didn't. Whot is ye doin' yere?' sez he. 'Only pursuin' a jug o' blue ruin I'se out thar hid under a log,' sez I. Ye knows it'r agin rule ter tote it inside, but a feller must lick.' 'Wall, lick up ter-morrer,' sez he. 'We's got 'ticklar orders ter let no 'un out ter-night.' 'Blast the orders,' sez I. 'Ye'd loike a swig yerself.' 'Wall, I would,' sez he. 'Wull ye go snacks?' 'Yas,' sez I; 'an' guv ye chock-heapin' measure, fur I *must* hev some o' thet afore mornin'.' Thet brung him, an' I piked off for the ruin. (It warn't

thar, ye knows—I niver totch the dingnation stuff.) Ye'd better b'lieve the grass didn't grow under my feet when onst I got inter the woods. I plumb'd my coorse by the stars an' made ten right smart miles in no time.

"I'd got ter be right wall tuckered out by thet time. So I put fur a piece uv timber, lay down under a tree, an' went ter sleep. I must hev slept mighty sound till 'long 'bout mornin', when I woke up. Then I luck'd all round an' seed nuthin', but I yered—not a mile off—the hounds a bayin' away loike a young thunder-gust. I luck'd at the 'volver I'd stolè from the soger, seed it war all right, an' then clumb a tree. 'Bout so quick as it takes ter tell it the hounds—two 'mazin' fine critters, wuth a hundred an' fifty apiece—was on me. I run my eye 'long the pistol-barr'l an' let drive. It tuck jest two shots ter kill 'em. I know'd the Secesh was a follerin' the dogs, so ye'd better b'lieve I made purty tall racin' time till I got ter the eend uv the timber.

"Jest at night I run agin some darkeys, who guv me suthin ter eat, an' nothin' more happin'd 'fore the next night, when I come in sight o' home. I got ter the edge uv the woods, on the hill jest ahind uv my barn, 'bout a hour by sun; but I darn't go down, fur, ye knows, the house stood in a clarin', an' some uv the varmunts mought be a watchin' fur me. I lay thar till it war thick dark, an' then I crept ter the r'ar door. I listened; an' whot d'ye s'pose I yered? Sally a prayin'—an' prayin' fur me, so 'arnest an' so tender loike, thet I sot down on the doorstep an' cried loike a child—I did.

"She telled the Lord how much I war to har; how she'd a loved mé uver sense she'd a fust seed me; how 'fore har father, or mother, or even the chillen, she loved me; how she'd tried ter make me love Him; how she know'd thet, way down in my heart, I did love Him, though I didn't say so, 'case men doan't speak out 'bout sech things loike wimmin does. An' she telled Him how she hed tried ter do His will; tried ter be one on His raal chillen; an' she telled Him He hed promised not ter lay onter His chillen no more'n they could b'ar, an' she couldn't b'ar ter hev me hung up as ef I war a traitor: thet she could part wuth me if it war best; thet she could see me die, an' not weep a tear, ef I could only die loike a man, wuth a musket in my hand, a doin' suthin' for my kentry. Then she prayed Him ter send me back ter har fur jest one day, so she mought ax me once more ter love Him—an' she know'd I would love Him ef she axed me agin—an' she said ef He'd only do thet, she'd—much as she loved me—she'd

send me away, an' guv me all up ter Him an' the kentry fur uver!

"I couldn't stand no more, so I opened the door, drapped onter my knees, tuck har inter my arms, lay my head on har shoulder, an' sobbed out: 'The Lord hes yered ye, Sally! I wull love Him! I wull be worthy of sech love as ye's guv'n me, Sally!'"

He paused for a moment, and covered his face with his hands. When he spoke again there was a softness and tenderness in his tone that I never heard in the voice of but one other man.

"Sense thet minnit this yerth hes been another yerth ter me; an' though I'se lost uvery thin', though I hes no home, though night arter night I sleeps out in the cold an' the wet, a scout-in', though my wife an' chillen is scattered, though nigh uvery day I'se in danger uv the gallus, though I'se been roped ter a tree ter die loike a dog, though a thousand bullets hes yelled death in my yeres, though I'se seed my only boy shot down afore my vury eyes, an' I not able ter speak ter him, ter guv him a mossel uv comfort, or ter yere his last word, I'se hed suthin allers yere (laying his hand on his heart) thet hes helt me up, an' made me luck death in the face as ef I loved it. An' ef ye hain't got thet, no matter whot else ye's got, no matter whot money, or larnin', or friends, ye's pore—pore nur I ar!"

I made no reply, and after a short silence he resumed his story.

"Jake—thet war my boy—ye remember him, ye hed him on yer knee—he war eighteen an' a man grow'd then: wall, Jake an' me made up our minds ter pike fur the Union lines ter onst. Sally war all night a cookin' fur us, an' we a gittin' the arms an' fixin's a ready—we hed lots o' them b'longin' ter the Guards, hid away in a panel uv the wall—an' the next day, meanin' ter start jest arter sunset, we laid down fur some sleepin'. Nigh onter dark, Black Jake, who war a watchin', come rushin' inter the house, sayin' the Secesh was a comin'. Thar was only twenty on 'em, he said, an' one was drunk an' didn't count fur nuthin', so we detarmined ter meet 'em. We tuck our stands nigh the door, each on us men—Black Jake, the boy, an' me—wuth a Derringer in his pocket, two 'volvers in his belt, an' a bowie-knife in the breast uv his waiscoat, an' the wimmin wuth a 'volver in each hand, an' waited fur 'em. Half a dozen on 'em went round ter the r'ar, an' the rest come at the front door, yellin' out:

"We doan't want ter 'sturb ye, Miss Smith, but we reckons yer husban' are yere, an' we must sarch the house. We hes orders ter take him."

"I opened the door stret off, an' steppin'

down onter the piazzer—Black Jake an' the boy ter my back, an' the wimmin' ter the winder—I sez ter 'em,

“ ‘Wall, I'se yere. Take me ef ye kin!’ ”

“ ‘They was fourteen on 'em, uvery man wuth a musket, but they darn't lift a leg! They was cowards. It'r nuthin' but a good cause thet guvs a man courage—makes him luck death in the face as ef he loved it. ’

“ ‘Wall, they begun ter parley. ‘We doan't want ter shed no blood,’ said the leftenant; ‘but we's orders ter take ye, Mister Smith, an' ye'd better go wuth us, peaceable loike.’ ”

“ ‘I sha'n't go wuth ye peaceable loike, nur no other how,’ sez I; ‘fur ye's a pack o' howlin' thieves an' traitors as no decent man 'ud be seed in company uv. Ye disgraces the green yerth ye walks on, an' ef ye doan't git off uv my sheer uv it, in less nur no time, I'll send ye—though it'r agin my principles ter take humin life—whar ye'll git yer desarts, sartin.’ ”

“ ‘Then the leftenant he begun ter parley agin, but I pinted my 'volver at him, an' telled him he'd better be a moseyin' sudden. Sayin' he'd 'port ter his cunnel, he done it. ’

“ ‘We know'd a hun'ed on 'em 'ud be thar in no time, so, soon as they was out o' sight, the boy an' me, leavin' Black Jake ter luck arter the wimmin, struck a stret line fur the timber. We hedn't got more'n four mile—ter the top uv the tall summit ter the r'ar uv Richmond—afore, luckin' back, we seed my house an' barns all a blazin'! The Heaven defyin' villuns hed come back—shot Jake down in cold blood, druv my wife an' darter out o' doors, an' burnt all I hed ter the ground! We seed the fire, but not knowin' whot else hed happin'd, an' not bein' able ter do nothin', we piked on inter the woods. ’

“ ‘We traviled all thet night through the timber, an' jest at sundown uv the next day come ter a clarin'. We was mighty tired, but 'twouldn't do ter sleep thar, fur the trees was nigh a rod asunder; so we luck'd round, an' on t'other side uv the road, not half a mile off, seed 'bout a acre uv laurel bush—ye knows whot them is, some on 'em so thick a dog karn't git through 'em. Jake war tireder nur I war, an' he said ter me, ‘Dad,’ sez he, ‘let us git under kiver ter onst. I feels loike I couldn't stand up no longer.’ It was fool-hardy loike, fur the sun warn't clar down, but I couldn't b'ar ter see the boy so, an', agin my judgment, we went down the road ter the laurels. We lay thar till mornin', an' slep' so sound thet I reckon ef forty yerthquakes hed shuck the yerth they wouldn't hev woked us. Soon as sun-up Jake riz an' went ter the edge uv the thicket ter rekonoitter. ’

He hedn't stood thar five minnits—right in plain sight, an' not more'n two hun'ed rods frum me—afore I yered a shot, an' seed the pore boy throw up his arms an' fall ter the ground. In less nur no time fifty Secesh was on him. I war springin' up ter go ter him, when suthin' tuck me by the shoulder, helt me back, an' said ter me, ‘Ye karn't do nothin' fur him. Leave 'im ter the Lord. Save yerself fur the kentry.’ It went agin natur', but it 'peared the Lord's voice, so I crouched down agin 'mong the bushes. I niver know'd whot it war thet saved me till nigh a y'ar arterwuds. Then I tuck thet leftenant pris'ner—I could hev shot him, but I guv him his life ter repent in, an' he done it: he's a decent man now, b'longin' ter Cunnel Johnson's rigiment. Wall, I tuck him, an' he said ter me, ‘I was aside uv thet pore boy when he war dyin'. He turned his eyes onter me jest as he war goin', an' he said, “Ye karn't kotch him! He's out o' the bush! Ha! ha!” He said thet, and died. Ter save me, died wuth a lie on his lips! Does ye b'lieve the Lord laid thet agin him?’ ”

“ ‘No, no! I am sure not. It was a noble action.’ ”

“ ‘It 'pears so ter me, but it war loike the boy. He war allers furgettin' himself, an' thinkin' uv other folk. He war all—all the pride uv my life—him an' Sally—but it pleased the Lord ter tuck him afore me—but only fur a time—only fur a time—fore long I shill hev him agin—agin—up thar—up thar!’ ”

His emotion choked his utterance for a while. When he resumed, he said,

“ ‘At the eend uv a farni't, trav'lin' by night an' sleepin' by day, an' livin' on the darkeys when my fixin's guv out, I got inter the Union lines 'bove Nashville.’ ”

“ ‘And what became of your wife and daughter?’ I asked. ’

“ ‘Lettie Sally went ter har sister. My wife walked eighty mile ter har father's. He's one on yer quality folk, an' a durned old Secesh, but he's got humin natur' in him, an' Sally's safe thar. I'se seed har twice ter his house. The old 'un he's know'd ont't, but he hain't niver said a word.’ ”

Bible's intimate knowledge of the country, and acquaintance with the loyal men of the district, induced General Rosecrans to make him a scout, and he has performed more actual service to the Union cause than a regiment of men in the ranks. Hiding in the woods, or secret-ing himself in the houses of his friends by day, he sallies forth by night, and, penetrating far into the rebel lines, frequently gathers informa-

tion of great importance to our army. Often days without food, sleeping out in the cold and the rain, hunted down with blood-hounds, betrayed by pretended friends, waylaid by whole regiments, the mark for a thousand rifles, and with the gallows ever before him, he goes on in his perilous work with a single-hearted devotion to his country, and an earnest, child-like reliance on God, that would do honor to the best names in history. His scouting adventures would fill a volume, and read more like a romance of the Middle Ages than a matter-of-fact history of the present time. I will narrate but one, mostly in his own words.

On one occasion, when about five miles outside of our lines, he came, late at night, upon a party of officers making merry at the house of a wealthy Secessionist. Riding coolly up to the mounted orderly on guard before the doorway, he pinioned his arms, thrust a handkerchief into his mouth, and led him quietly out of hearing. Then bidding him dismount, and tying him to a tree, he interrogated his prisoner, and learned that the party consisted of nine officers; that their arms were piled in the hall, and that only one of them, a surgeon, had a revolver.

Fastening his horse in "the timber," and creeping up to the house, he then reconnoitred the kitchen premises. The old man—a stout, stalwart negro of about fifty—sat dozing in the corner, and his wife, a young mulatto woman, was cooking wild-fowl over the fire. Opening the door, and placing his finger on his lips to enjoin silence, Bible beckoned to the woman. She came to him, and, looking her full in the eye for a moment, he said to her; "I kin trust ye. Wud ye an' yer old 'un loike ter git out o' the claws uv these durned Secesh?"

"Yas, yas, Massa," she replied, "we wud. We's Union! We'd loike ter git 'way, Massa!"

Then awakening her husband, Bible said to him: "Uncle, wud ye risk yer life fur yer freedom?"

"Ef dar's a chance, Massa, a right smart chance. Dis dark'y tinks a heap ob his life, he does, Massa. It 'm 'bout all hem got, but I loikes a chance, Massa, a right smart chance."

Bible soon convinced the negro that he would have a "right smart chance," and he consented to make the hazardous strike for his freedom. Entering the house, he returned in a few moments to the scout, confirming the sentinel's report: the weapons were reposing quietly in the hall, near the doorway, and the officers, very much the worse for liquor, were carousing with his master in the dining-room. Selecting two of the best horses, from the stables, Bible di-

rected the yellow woman to lead them into the road, and to bring his own from where it was fastened in the woods. Then, with his sooty ally, he entered the mansion. Removing the arms from the hall, he walked boldly into the dining-room.

"Gentlemen," he said, pointing his pistols—one in each hand—at the rebel officers, "ye is my pris'ners. Surrender yer shootin' irons, or ye's dade men."

"Who are you?" exclaimed one of them, as they all sprang to their feet.

"Cunnel Smith, uv the Fust Tennessee Nigger Regiment—one old black man an' a yaller 'ooman," coolly replied the scout.

"Go to —," shouted the surgeon, quickly drawing his revolver, and discharging it directly at Bible's face. The ball grazed the scout's head, cut off a lock of hair just above his ear, and lodged in the wall at his back. The report was still sounding through the apartment when the surgeon uttered a wild cry, sprang a few feet into the air, and fell lifeless to the floor! The negro had shot him.

"Come, gentlemen, none o' thet," said Bible, as coolly as if nothing had happened, "guv me the shootin' iron, and surrender."

Without more hesitation the colonel handed the scout the fallen man's pistol, and then, they all, followed by the scout and the negro, marched quietly out of the front door. The mulatto woman, holding the horses, was standing in the highway.

"Hitch the nags, my purty gal," said the scout, "an' git a coil. An' ye, gentlemen, sot down, an' say nothin'—'cept it mought be yer prayers; but them, I reckon, ye hain't larned yit."

The negress soon returned with the rope, and while Bible and her husband covered them with their revolvers, she tied the arms of the prisoners. When this was done, the scout affixed a long rope to the waist of the officer on either flank of the column, and, taking one in his own hand, and giving the other to the negro, cried out:

"Sogers uv the Fust Tennessee! Mount!"

The regiment bounded into the saddle, and in that plight—the planter and the eight captive officers marching on before, the self-appointed "cunnel" and his chief officer bringing up the rear, and the rest of his command—the yellow woman—a-straddle of a horse between them, they entered the Union lines.

I could fill this article with Bible's scouting adventures, but it is my purpose to say only enough of him to give an idea of his character.

If I have outlined that distinctly the reader has perceived that he is brave, simple-hearted, outspoken, hospitable, enterprising, industrious, loyal to liberty, earnest in his convictions—though ignorantly confounding names with things—a good husband and father, with a talent for bragging, and that quiet humor which flavors character as Worcester sauce flavors a good dinner. In all these particulars he is a representative of his class; and his stories and conversation illustrate that disposition to magnify every thing—even himself—and that intensity of nature which leads the Southerner to do nothing by halves; to throw his whole soul into every thing he undertakes; to be, like Jeremiah's figs, "if good, very good; if bad, not fit to feed the pigs."

At the outset of Bible's career he had but one slave—poor Jake, who was "faithful unto death"—and the farmers of his class seldom own more than one, and generally they have none at all. In rare instances, however, the more industrious acquire five or ten; but whether they have many or few they work side by side with them in the fields, and treat them very much as the Northern farmer treats his hired workmen.

Before the war the traveler in the interior of North Carolina would have heard the axe of master and man felling with alternate strokes in the depths of the evergreen forest, or he would have seen the two "camped out" together in the same tent or pine-pole cabin, drinking from the same gourd—the darkey always after his master—eating from the same rude table, and sharing the same bed—the cabin floor—in common. So, too, in Kentucky, Tennessee, Missouri, Western Virginia, and Middle and Upper Georgia, Alabama, and Mississippi, he would have seen the white and the black plowing side by side, or, bared to the waist, swinging the old-fashioned scythe, in good-natured rivalry as to which could cut the broadest swath of yellow wheat or waving timothy, or tote the biggest bundle of corn to the evening husking-bee. And when the evening had come he would have found them gathered in the old log-barn, husking, and singing, and shouting, and dancing in company, to the tune of "Ole Virginny," or "Rose, Rose, de coal brack Rose," played by "old Uncle Ned," who "had no wool on de top ob his head," but whose skinny fingers, with handy blow, *could* rap the music out of "de ole banjo."

Bible had got "no furdur nur prent yit," and fully one half of his class never get so far as that, though the more wealthy, like the father of Sally, sometimes give their children what might be called "a fair common-school education."

The reason of this is, there are no schools for the common people at the South. In a village, ten or twenty miles distant, there may be a pretentious "Female College," or "Institute of Learning for Young Men," where "a little Latin and less Greek" is dispensed to the young idea at the rate of four or five hundred dollars per annum, but these prices place their "stores of knowledge" far above the reach of the hard-toiling farmer. Only in Tennessee, so far as I know, are there any free schools, and the scanty State allowance which formerly supported them was dealt out with a most parsimonious hand. How much light those institutions gave the people may be guessed at from the fact that any one was qualified to instruct in them who could "read, write, and do sums in addition."

But the fact that a large proportion of the Southern farmers have no "book-larnin'" is no evidence against their intelligence. At the North if a man has not been to school he knows nothing. The South is more like Greece and Rome, where one might be really *educated* and yet not know how to read and write. Reading and writing at the South is considered something like playing on the piano at the North—an accomplishment rather than a necessary. The men of this class, of the better order, however (as in the case of Bible Smith and the father of Thomas Jefferson), almost always marry above them, so that not unfrequently the wife reads while the husband can not; of course the children have the advantage of the mother's education, and, therefore, the class is constantly rising. They have also a sort of innate faculty for culture and gentlemanliness, and this makes a little "book-breedin'" go a long ways.

But as the Southern farmer can not read, he is forced to derive his knowledge of current events and political affairs from his wealthier neighbor who can read, and who is sure to be a slave-owner. At a political barbecue, or a court-day gathering, he may hear, once or twice in the year, the two sides of every national question but the, to him, all-important one of slavery. If that subject is at all touched upon on such occasions, it is shown to be of divine origin—dating back to the time when Ham first cast a black shadow across his looking-glass, and only to end when the skins of his descendants no longer wear mourning for their forefather's sin. Thus instructed, is it strange the Southern farmer deems slavery altogether lovelier than freedom? What does he know of real freedom? What does he know of what it has done for the poor man at the North? Nothing. He never saw a Northern man in all his life, ex-

cept, it may be, a Yankee peddler. If the Southern workingman knew what freedom is; if he knew how it has built a free school at every Northern cross-road; how the Northern laborer is comparatively rich, while *he* is wretchedly poor; how the Northern farmer has a comfortable house for himself and outbuildings for his cattle, while *he* lodges in a mud-chinked hovel, and stables his cows in the woods; how the Northern farmer is respected and honored *because* he labors, while *he* is looked down upon and despised for doing the same thing; if he knew all this, would he not crush slavery and end the rebellion in a day? He would. And slavery will not be effectually crushed, or the rebellion ended, until he *does* know it. We may overrun the South, we may make its fields a desolation, and its cities heaps of ruin, but until we reach the reason and the hearts of these men, we shall stand ever on the crater of a volcano, whose red-hot lava may at any hour again burst forth and deluge the land with blood and fire!

But how—while every able-bodied Southern man is in the army—can we reach these people? By fighting them with a sword in one hand and a Union newspaper in the other—by giving them ideas as well as bullets. By scattering loyal publications broadcast over the conquered districts, and by starting a free press wherever

we hold a foot of Southern soil. If the men are away in the army, the women will be at home, and will read these things, and that will be enough. If we convert *them*, the country is saved. Woman, in this century, is every where that “power behind the throne” which is mightier than the throne itself, and the Southern women have been, and are, the mainspring of this rebellion. Every dollar thus planted in the South would spring up a man, in tattered hat and ragged butternuts, it might be, but still a man, hardy, earnest, brave—who for what he thought was right would march straight up to the cannon’s mouth, and meet death “as if he loved it.”

I have failed of my purpose in writing this article if I have not shown that the great body of “poor Southern whites” are an honest, industrious, enterprising, brave, and liberty-loving people, who need only to know the true issues of this contest to become the firm friends and supporters of the Union. Henceforth they must be the real South. We must enlighten and elevate them. Only in that way can we uproot the despotic power of the aristocracy, and plant in the South a loyal element which will make it one with the North in interest and in feeling. Only in that way can we secure lasting peace, and freedom, and Union, to our distracted country.

HARPER'S NEW MONTHLY MAGAZINE — JULY, 1866

THE EDUCATION OF THE COLORED POPULATION OF LOUISIANA

By Nathan Willey

ONLY a few years elapsed after the settlement of Louisiana in 1699 by the French, before slave labor was introduced to aid in developing its resources and sustaining the colonists. For a century and a half since that period has the contest between freedom and slavery been waged there, and always under circumstances favorable to the latter. In many of the English colonies along the Atlantic coast loud and repeated remonstrances, until the era of the Revolution, were made to the mother country against the introduction of this element among the population; but in the early history of Louisiana we find that no systematic opposition was made to the use of slaves, or apprehension of future evils by their presence. The early governors welcomed slavery as the only means of causing prosperity to visit their country, and the whole moral and political influence of the

people was in favor of its general adoption as a part of the political economy of the country. The monarchs of France regarded slavery as a proper element of industry in their colonies, and as long as their revenues were increased by the slave-trade they saw nothing but humanity and civilization in its practice.

The early history of this State blends the sober realities of truth with the poetry and romance of the Middle Ages. The chivalry of France and Spain watched over the birth of Louisiana. Kings and statesmen fostered its early growth, and the treasures of Louis XIV. were liberally expended to make it a success. Every thing which wealth, power, or influence could do was employed to make this colony one of the most favored in the New World. More than three hundred years ago its mighty forests, its endless swamps, and majestic rivers were

crossed by De Soto, who, returning after a fruitless search for gold, when worn out by toil and disappointment, was buried beneath the turbid waves of the "Father of Waters," which he was the first to discover. A century and a half later other adventurous spirits attempted to explore and settle this country. Long before the English had made any explorations beyond the Atlantic coast and fringed the ocean with their settlements the French Jesuits had penetrated to Lake Superior, and, descending southward from the Great Lakes, had mapped out the country from the Falls of Saint Anthony to the Gulf of Mexico. Among these missionaries and adventurers are names which history will never pass over in silence. Nearly a hundred and ninety-three years ago Father Marquette and Joliet were the first explorers of the Mississippi. Seven years later Robert Cavalier de la Salle and Chevalier de Tonti descended this river to its mouth, and lived to tell of its grandeur in the gay salons of Paris. Following these heralds of a new empire came Iberville, Bienville, and Father Anastase, the founders of the first permanent settlement in the State, and the spring of the last year of the seventeenth century saw their first rude cabins erected on the bay of Biloxi.

But prosperity avoided the little colony at Biloxi. The settlers were accustomed to the bracing atmosphere of Canada and the milder breezes of France, and could hardly endure the burning heat of the sun and pestilential vapors of this semi-tropical clime. Sicknes and death invaded their ranks, and their ignorance of the diseases peculiar to this climate carried many of them to a premature grave.

As early as the year 1708 the colony favored the introduction of slave labor. It had already been introduced into the West Indies from Africa, and it was very naturally supposed that it was essential to the prosperity of the country. Indians were first taken and compelled to work for the colonists, but they were soon found to be unprofitable, for they could not be confined to their masters' plantations. The same practice had already been tried in Massachusetts and Connecticut with a similar want of success. In order to supply the great demand for labor, Bienville, the Governor of the colony, wrote to the French Government proposing to exchange Indians for negroes with the West India Islands, but his request met with an unfavorable reception. When the entire control of the colony passed into the hands of Anthony Crozat, in the year 1712, slavery was already introduced, and he was authorized to perpetuate it by send-

ing a ship once a year to Africa for negroes to be employed by the inhabitants as slaves. From this time, when slavery was first legally established in the colony, until the Proclamation of Emancipation—one hundred and fifty years—has the system of slave labor been tried with every facility for rendering it successful. It commenced when the colony numbered only about three or four hundred inhabitants; it has ever since been fostered by Legislative enactments and judicial decisions; it has struck its roots deep into the social system, and is it strange that it should be difficult to eradicate?

From Crozat the colony passed into the hands of the Company of the Indies, whose act of incorporation required that the demand for labor should be supplied with three thousand negroes. In all succeeding administrations slave labor seemed to be regarded as essential to the success of the colony, and until the last few years it has been the fixed policy of the people to make such laws as would protect it and render it perpetual.

The "Black Code," first established by Bienville, has ever been the model for all legislation on this subject. When the colony was first taken possession of by the Crown of Spain, in the year 1769, the laws of the Black Code were retained with such modifications as the *Siete Partidas* made on the subject of slavery. This system of laws, first completed in the year 1263, has ever since been the Blackstone of Spain and her colonies. Although founded on the Roman civil law, it is the most complete and well digested system of laws on the Continent of Europe, and is still the authority in the countries of America settled by the Spaniards. In this system of law the subject of slavery is well defined, and the regulations are evidently based on the code of Justinian. The old Spaniards seemed to have no scruples about the justice of this institution; their long wars with the swarthy Moors, and their proximity to the African coast, conspired to make them look upon this subject with complacency and lend it their sanction.

The early settlers of Louisiana were mostly descendants of the "Latin races." With the exception of a few Germans who settled in the parishes of St. John the Baptist and St. James, and who have now lost all trace of their former language and nationality, this State, up to the beginning of the present century, was settled wholly by people from countries bordering on the Mediterranean. In nearly every city the peoples of France, Spain, Italy, and Portugal are represented. They brought with them their customs, language, and their religion which

they have carefully preserved. In one half of New Orleans one finds little to remind him that he is in America. He hears a foreign language in the streets, the shops, and the cafés. He finds hundreds of people not able to speak the English language, and who have never regarded themselves as Americans although natives of the United States. In most of the schools the textbooks and all the exercises are in the French language, and English is taught as a separate branch. When he enters the courts of justice, he finds the civil law to be the basis of all judicial proceedings, the *Code Napoleon* and the *Partidas* are oftener quoted than the commentaries of Blackstone and Kent, and often the examination of the witnesses and the pleadings of the counsel are in a foreign tongue.

This peculiar state of society in New Orleans has not been without its influence on the free colored population, who have become an element which will well repay examination. While the statute laws of Louisiana have been very severe against the marriage of whites with people of color, the social customs have tolerated it in a great degree. Since the first introduction of negroes into the colony a mixed race has existed there. The cohabitation of colored persons with whites is not allowed to have any legal effect; but the Catholic church recognizes unions of this kind, and binds the husband to support and provide for his offspring. This, however, does not prevent him from entering upon other marital relations.

Among the French and Spanish settlers and their descendants, the *condition* of the colored people, rather than their *color* as a badge of slavery, has been the subject of popular prejudice. They looked upon a slave and his descendants as an inferior class, simply because they were in a degrading condition of servitude, and not because they bore a darker skin. In the North and in States settled by the English the prejudice is one of color rather than condition. Here the colored man is tabooed, no matter what his antecedents may have been; the emancipated slave, just free from his master, is as much honored and respected as he who can trace his lineage through several generations of freedmen. The slightest admixture of African blood is fatal, not only to his social standing, but even, as a general thing, to his respectability; and this interpretation of the social laws is the one usually adhered to by the "American" population of the State.

After the revolution in Saint Domingo a great number of free people of color came to New Orleans to reside. Many of them were men of

wealth and culture, owning large properties in that island, who had received their education in France. The French was their native tongue, and their early associations were with this race, which never carried the prejudice against color to the same unwarrantable extent which has prevailed in the United States. In their new home they found a State of society congenial to their taste; and, modified by their presence, it became one of the peculiarities of the Crescent City. From these people had arisen a class which is different from any other in the Union. They have been accorded many privileges and rights, which one would hardly expect in a State where the laws against education are as stringent as they appear on the statute books. Among the French and Spanish settlers an entirely different feeling existed toward their children of a mixed race from that which the emigrants from the States usually manifested. A man of the former class never appeared to regard such offspring as attaching any disgrace to his character, and was usually desirous of having them educated and trained up in such a manner that they would be an honor to himself. If he were living with a slave, it was the usual practice to emancipate her before she became a mother, in order that her children might be free, and the consequence was that they were sent to private schools, and obtained such an education as the father could afford to give them.

It sometimes happened, if the father were a man of wealth and influence, that the free child of a mixed race was sent to the most fashionable schools in the city, and it was no uncommon thing for them to be sent to the white boarding-schools at the North. In the former case the wealth and respectability of the parent was a sufficient guarantee for the admission of the pupil. In many instances they were educated in the best schools in France.

The number of these colored creoles who have received a foreign education can not be exactly stated, but it will not fall much short of two thousand. Among this class are many who have already obtained prominent positions among the people of their own color. Some are merchants, who are transacting a wholesale business with the principal houses in France; some are bankers, some are editors, and some are physicians, who have a large and lucrative practice, and have received their diplomas from the University of Paris. The profession of law has been so jealously guarded that they have never been allowed to practice in the courts, and their energies have been mostly confined to the medical profession and the various pursuits of trade.

Their style of living and dress corresponds to their circumstances. In fine, I very much doubt whether there is another city in the United States where so large a colored population exist who are so prosperous and well-educated as in New Orleans.

The consequence of this state of society has been, that in this city private schools for colored people have long existed and prospered. The law has tolerated them by a significant silence on the subject. Public opinion has also tolerated them by a *quasi* encouragement and patronage. Under the old régime this was one of the delicate subjects which the people did not think it best to interfere with in advance. They reasoned thus: "Any thing so weak and insignificant as these schools appear to be can be let alone till some solid reason arises for suppressing them, meanwhile we are strong enough to protect ourselves against any evil results from this course." An opposite course might have defeated their own ends, and given some excuse for an excitement on the delicate subject of negro insurrections. So the law held its power in reserve, and while it placed heavy fines and punishments on those who taught the slave population, and kept a strict watch over the movements of the colored people, especially their religious meetings and social gatherings, it refrained from going any further.

But among this class of people there are social chasms as wide and deep as between themselves and the whites. Aristocracy is not confined to color, race, or condition. The very fact that the stringency of social laws shuts them out from all familiar intercourse with the white races; that they are obliged to worship in their own temples, attend their own places of amusement, educate their children at their own schools, and live as a separate and distinct class of people; and above all, that they have no political power, tends to develop this trait of character. It is unavoidable, and in some extent necessary, in order to enable them to preserve their own self-respect.

The same contracted views prevail on the subject of religion and education. The French creoles are mostly Catholics; and this is the creed which usually prevails in their private schools, although I am not aware that any of them require any religious test of their pupils or their patrons. Their sympathy for every thing French leads them to adopt the national religion of that country. These people have little to do with the Freedmen's Bureau, and do not recognize it as having any application to themselves. They object to being placed in the same class

with the freedmen just released from bondage, and seem to feel that they are a superior race, in the enjoyment of advantages which their less fortunate neighbors never obtained.

Many of these free people of color have been slave-owners, sometimes the husband purchased his wife, and occasionally a husband was owned by a free woman. In some parts of the State they own large plantations, and occasionally had the reputation of being far more severe toward their slaves than the whites. During the recent war many of this class were as strongly in favor of the rebellion as the veriest fire-eater whom South Carolina ever produced, and they defended the divine right of slavery as zealously as any of the disciples of Calhoun or De Bow. They as firmly believe that the inferiority of condition necessarily attaches to itself a lasting dishonor as the whites do that color is a badge of an inferior race.

Mr. Bouguille, a very successful colored creole teacher in New Orleans, relates an instance illustrating this current of popular opinion among the people of his acquaintance. On one occasion, long before the war, he was the recipient of a bright-looking boy, whose master and father solicited the favor of his attending school. Mr. B. made no objections, as the respectability and standing of the father was a sufficient guarantee that no legal proceedings would result from the act; but after a few days he found that every one of his pupils had decided to leave him. They had found out that a slave was being taught in the same room with themselves, and their parents would not allow such an indignity to be perpetrated upon them. Finally, Mr. B. was obliged to compromise the matter by dismissing the slave pupil, and calling every day at his master's house to give him instruction. His pupils agreed to remain, and the school prospered as usual.

It has already been shown that these free people of color not only copy our prejudices but sometimes improve on the original. With a little observation one will find that their standard of respectability contains as many different strata as Hugh Miller discovered in the Old Red Sandstone—with about as many fossil ideas as he found classes of distinct vertebrata. Especially is this the case in their schools. In some of these private institutions the standard of respectability is very high, and only those of the best society, and whose skin is tolerably well bleached with an admixture of Caucasian blood, can be admitted. In others the grade is placed lower, but the same principle is recognized; while the great majority of the Professors make

the social condition of the parents the only criterion. The majority of these schools are open to all pupils who were born free, and whose parents can afford to pay the monthly stipend required. They are usually held in private houses,

without any external appearance which would indicate that the building was used for educational purposes. In former times the greatest care was often taken to conceal this fact, especially when there was any pretext for complaint.

HARPER'S NEW MONTHLY MAGAZINE — APRIL, 1865

A SERMON TO SERVANTS

WHILE traveling through Tennessee, some years ago, I happened to hear a sermon which I think worth reporting. The preacher was a clergyman who had just purchased a plantation with the slaves upon it. This was the first Sunday of his occupancy, and I was informed that he proposed to inaugurate his new "settlement" by instructing his people as to their duties and obligations. The meeting was held in the wheel-shed. The audience, an unwashed, uncombed group of negro men, women, and children, stood before the preacher, who was seated upon the tongue of the cart. After a hymn had been sung the preacher proceeded to hold forth from the text, "Servants, obey your masters according to the flesh."

"My colored friends," he began, reading from a paper which he skillfully concealed from his hearers between the leaves of the Hymn-Book, "we have but a very short time sustained to each other the relation of master and servant. I do not know how well you may have been instructed as to the duties of this relation; but I consider that I am called upon this occasion, the first upon which we have assembled ourselves together for the worship of God, to speak to you on the subject of your duties to me your master. And, first, I will consider what your duties are."

Here the reverend gentleman closed his book, and entered upon an extemporaneous address.

"In the first place, it is your duty to rise promptly in the morning at the blowing of the horn. Too much sleep is not good for either body or mind. All through this blessed Book," he continued, holding up by mistake the Hymn-Book, "if you could read you would find exhortations on the subject of oversleeping, and warnings against it. There is no greater temptation to which you are exposed than that of yielding to an inclination to sleep. It is the besetting sin of your race. 'A little more sleep, a little more slumber, a little more folding of the hands together,' is the language of your hearts. Now, this is nothing more nor less than a temptation of that old wicked serpent, the

Devil, who first deceived our parents in the garden of Paradise, and who goes about like a roaring lion seeking whom he may devour. Now, if you yield to this temptation, you will surely be devoured by the Devil. Your souls will surely be lost; everlasting destruction and eternal woe will be your portion forever among the fiends of hell. I know it seems a little hard, especially if the morning is a little cold, to resist the temptation to sleep; but you must, or burn forever in a fire of brimstone and sulphur ten thousand million times hotter than the hottest fire you ever felt in your lives, where the worm dieth not, and the fire is not quenched. And there you will have to burn for ever and ever. When you have suffered there millions and billions and trillions of years, your suffering will just be begun. You will have to stay there as long after that lapse of time as though you had not been there a second.

"Just think for a moment of the greatness of your sin! Your kind, trusting master, who has the bronchitis, and knows not what it is to have a well day, gets up early in the cold morning, and stands undressed at the open door or window, with the cold blast blowing upon him, liable to take his death by cold, and blows his horn. With a trusting heart he returns to his bed, believing that his servants think enough of him to obey the summons to rise. Now think of his disappointment and your sin when he awakes two hours after to find his confidence betrayed and you in bed; to find that, instead of being up and about your work like faithful servants, you are wasting in slumber his precious time. For when you oversleep your hour, it is not your time but mine you are squandering, and it's just as wicked and hell-deserving to waste my time as to steal my money. You have no time—not a second—except what I in my kindness grant you, for you are my property. I have bought you, paid money for you earned by hard labor, riding on horseback in the blazing midsummer sun, and in the cold and rain, and snow and sleet, and preaching day and night, until I have worn myself out in the serv-

ice of God and my fellow-men; so that I feel that I can not last long; that my days here are numbered. I feel that you will not long have me for a master"—[Here the preacher was almost choked by his emotion].—"If you are unkind and unfaithful to me now, you will when you see me cold and stiff in my shroud, and hear the clods rattling on my coffin."—[At this point, unable to proceed, the speaker drew from his coat-pocket a red silk handkerchief, blew his nose, and wiped his eyes. Having recovered his composure somewhat by this diversion, he added, in low, tremulous tones]—"You will be stung by the worm of remorse."

This pathetic sentence, which brought tears to the eyes of many of his impulsive, demonstrative audience, closed the first portion of the discourse of this original sermonizer. Having disposed of this point the preacher proceeded to enlarge upon the other duties of slaves, some of which duties I think are not to be found in the code as given to Moses, or in that set forth by Christ and his Apostles. Notwithstanding this, his hearers were threatened, in case of their violation, with everlasting destruction of soul and body. He then proceeded, by what law of association I leave psychologists to explain, to set forth a somewhat original theology in something like these terms:

"You owe some duties to yourselves as well as to your master. It is your duty to improve the time which I will give you wisely. I'll give you Saturday night of each week after your day's work is done, and all the little jobs, such as feeding, milking, bringing the water, and chopping the wood for Sunday, etc. I can not give you any other night of the week, for you know there are a great many things to be done at night. There is the cotton to be baled, two cribs of corn to be shucked, and a part of it to be shelled for meal and hominy; wood to be chopped for the morning; apples and peaches to bring from the orchard and cut for drying; the geese to be picked and the sheep to be sheared; the pease and beans to be thrashed out, and spinning to be done. Now all these little things must be done at night, besides many more which I have not mentioned. We can't spend daylight on such trifles, because if we did the cotton would rot in the bolls. But the nights are getting long now, and if you will make out your plans, you can accomplish a great deal in a night. Now it is your duty to employ this night I give you profitably. I have proved that it is impossible for me to give you any but Saturday night. If I should give you any other you would sit up too late at your

work, and then would sleep over my work the next day.

"You will need to put you up some beds, and get some bed-clothing for the winter. And now, maybe, you would like to know how you can earn money for this purpose, and I'll tell you! You men can make bread-trays—there's plenty of fine cypress on the plantation; or you can braid foot-mats—plenty of nice white shucks at the cribs; or you can make brooms, and scrub-mops, and tables, and chests to sell. Or you can have coal-kilns; and any Saturday night, for a small share in the profits, I would let you take my wagon and horses and haul it into some blacksmith. Or you can have a patch and raise some sweet potatoes or water-melons or corn to sell. I'll go shares with any of you in this matter. I'll furnish the land, and you do the work on Saturday nights when there is a moon. Why there are a thousand ways"—exclaimed the preacher, enthusiastically—"in which you can make all the pocket-money you need. But mind, I'll have no raising of fowls and pigs for sale. They would get their living from my corn and wheat and oats; I should have to sustain them, be at all the expense of supplying them with food; and besides this, you would claim all the eggs on the plantation as laid by your hens, and would sell three times as many pigs and chickens as you raised. I've seen the thing tried too often. I know all about it. And there's to be no selling of apples and peaches; indeed, I might as well say it here as any where, you are not to go into my orchards at all. I shall need all the fruit that is not used in my family or dried for fattening my hogs. But there are always berries or nuts in the woods which you can gather and take to the village Saturday night or Sunday. I'm willing to give you a pass any time for this purpose. A little later and the persimmons will be ripe; you can dry them and make beer of them, and have it all winter to sell. Then there are partridge-eggs, you can get five cents a dozen for all you find; then you can have your traps for birds and coons and possums; I reckon partridges will bring five cents apiece this fall, and possums half a dollar; coons won't bring so much. Then any of you men or boys, by going into the village Sunday morning, can make a half dollar in no time by blacking the boots and brushing the coats for young men—the young lawyers and doctors and clerks who haven't servants; or you can make your dime or quarter by taking care of the horses of planters' sons while they are at church. Why there's no end to the ways in which you can make money. I believe if I was a nigger I could

get rich;" and the preacher smiled at his facetiousness, and most of his auditors smiled with him.

"As for you women, you can make money in almost all the ways I have mentioned; and besides, you can knit socks and stockings to sell. You can sew and wash for negroes round here who haven't any body to do these things for them, or who haven't, as you have, any time given them to work for themselves. You can spin some cotton—I sha'n't charge you any thing for the cotton you use—then double and twist it and carry it to the village and sell it to some merchant for wrapping-cord. Then you can make soap and sell it. You ought every one to have an ash-hopper, for I mean to allow you half the ashes you burn in your houses, and all the grease from the tops of the pots where you boil your bacon, and all the bones from the meat you eat; for bones when boiled in lye give out a good chance of grease. Then you can wash for young men in the village—carry the clean clothes in on Sunday morning and bring out the dirty ones. Then you can have all the goose-quills the geese lose. You'll find a ready sale for these. Some people will buy them for pens, and some for tooth-picks. Why it would take me all day to mention all the different ways in which you can make money, if you'll only go about it in the right way.

"And you must go to work immediately; there is no time to be lost. Even now, not to speak of the winter, you are in great need of a great many things. You must have kettles to boil your bacon in, and you need pot-hooks, and skillets, and lids, for the purpose of baking. You can't always bake your cakes in the ashes, and broil your meat on the coals, as you have done up to this time—there's too much waste in it. You'll never save any soap-grease in that way. You'll have to have tin buckets to carry your dinners to the field in, and tin cups to drink your buttermilk from. I can't have you using my vessels much longer; you'd soon have them battered to pieces. Then you want water-buckets, and plates, and cups and saucers, and knives and forks, and spoons. You see I am ambitious for you; I want you to live genteelly. In getting these things for yourself the expense, you see, is divided among you, and so cut up that you will hardly feel it; whereas, if I should undertake to get them all, it would come very hard upon me.

"Then there are your winter stockings. I don't want you to be hobbling around here this winter with frost-bitten feet and chilblains. Now I intend to furnish you with the cotton,

and so help you along; but you must spin and knit it, or get it done. The women can do this for themselves Saturday nights—there are a good many between this and cold weather—and the men can hire it done for a trifle.

Then about your winter clothing. Now some masters wouldn't trouble themselves about the matter. Mr. Haltom, over here, never bothers his head about such things; his niggers have to shift for themselves. But I don't mean to treat you in any such inhuman way. I mean to have the stuff spun for your winter clothes by the women at nights, and on rainy days, and when they are a little ailing—not well enough to do field-work; then I mean to get it wove, so that you'll have nothing to do but to see to the making, which you can do on Saturday nights. The men can't do their own sewing, but they can change work with the women—make them tables, or put them up shelves, or carry their stuff to the village and sell it for them, while the women do their sewing. Your mistress, of course, couldn't sew and knit for you all; it would come very hard upon her if she was to undertake it, but, divided among you, it would become very little. A woman who is smart with her needle can almost make a pair of pants in a night, and you know on Saturday nights you can sit up late, and work until midnight, because you can sleep late the next morning.

"Then you'll need shoes for the winter, but these won't cost you much; leather is cheap this Fall, and one pair will last through the winter, for your big feet are tough, and you can go barefooted until late, and turn your feet out to grass early"—here the orator smiled at his own wit. "Besides these necessary articles you'll want some nice clothes for church. You see I have some pride for my servants; I want them to appear as well as other folk's negroes. I hear Mr. Shoemaker brags a great deal about his plantation and niggers, and I want to be able to brag about mine."

At this speech of their new master's some of the motley audience smiled, but grimly enough; others displayed their great white teeth with well-pleased countenances; while others still looked sullen, as though determined not to be humbugged.

"Now you can go to your cabins," resumed the preacher. "I wish you to spend the Sabbath-day quietly and decently, for remember it is God's holy day. Think over seriously what I have said to you, and make out your plans. Lay out to-day your work for next Saturday night, and when the time comes go about it in earnest. If any of you wish to take a quiet walk into the

woods, to pick a few berries or nuts, why there is no harm in it. Some of you spoke about going to the village. If you will come to me after we have sung another hymn I'll give you passes, provided you'll promise not to stand around on the streets engaged in loud talking and laughing with other negroes. You must go there and attend to your trading, and then come directly home. I can see no harm in your going there quietly, attending to your business, and quietly returning home. Every body isn't required by God to keep the Sabbath in the same

way. You are simply not to do the same things on Sunday that you do during the week. The idea is relaxation from the work of the week. Besides, you are obliged to do some trading, and there's no other time but Sunday for you to do it."

With this orthodox thought the preacher closed his sermon, a hymn was sung, and then the negroes dispersed, their heads filled, doubtless, with thoughts of the money they were to make by the sale of shed goose-quills and partridge-eggs.

HARPER'S NEW MONTHLY MAGAZINE — OCTOBER, 1866

THE FREEDMAN'S STORY

By M. Shele De Vere

[I have thought that a plain, unvarnished account of a servant's trials in his efforts to secure his freedom might not be uninteresting. It is given as nearly as possible in his own words. Oby is now with me, my dining-room servant. He has learned to read himself what I have written.

CHARLOTTESVILLE, VIRGINIA.

M. S. DE V.]

MY name is Oby; they say it is because my father was an Obeah man, when he lived down South in Florida and drove a stage. I have heard him say, to the contrary, that he belonged, at the time I was born, to a man by the name of Overton, and that that is my true name. So when I went down to town the other day, and the Provost-Marshal asked me if I could sign my own name, I boldly wrote down "Mr. Overton Paragon."

I was raised at this place, by people who were ever so kind to me as long as I can remember them; but that was not very long, for they were poor white folks and could not keep me, or my mother, or my father either. So we were hired out to a very good master, who took good care of father especially, because he had hired him for more than twenty years, and I was living with them in his house, though I could not do much work, being rather weakly and, I am afraid, lazy too. One fine day master comes down stairs and says to father: "Uncle James, you have served me faithfully these ten years, and you know I only bought you because I did not want your master to set you in your old days to hard work. But I do not like to own you, and you are free. You can go whenever and wherever you choose. I can not give you your freedom in any other way, because the laws of the State do not permit me to do so, and we all have to obey the law; but you must understand

that you can stay or go as you choose."

Father could not say much, for he was not handy with his tongue, but he told master that he did not want to leave him as long as he cared to keep him. But when master had gone up again, he comes in and tells mother, and Uncle Henry, who was there, tells him he had better go across the line and live at the North. Father had been there when master sent him all the way to Boston with a fine horse—his name was Topaz—and they tried very hard then to make father stay. But he did not like their ways; he said they were not genteel at all like our old family servants, and he came back and was mighty glad to be again in Old Virginia. So father staid, and mother staid, and I was taken up to the dining-room, and mistress taught me to wait, and to wash the china and the glass.

I was nearly grown—I may have been about nineteen or twenty years old—when the Yankees came right down upon us. We had been expecting them often before, and many is the time Uncle Henry came running in where mother was and cried out, "God be thanked, they are coming, they are coming!" And mother asked him, "Who are you talking about?" and he would say, "Our deliverers, the Yankees, whom God sends to make us all free!" But mother did not like his ways at all, and when he was gone she would take me and brother Henry by her little stool close to the fire and say: "Now, boys, don't you think you'll be so much better off when you are free. Folks have to work every where, free or slave, black or white; and it's much better for you to be with genteel folks, and go to church, and have nothing to do with poor niggers, than to be way off, where you have not

any body who cares for you."

Mother was mighty good to us, and I know she meant it all for the best, but, to save my life, I could not help thinking of what Uncle Henry said, and what a fine thing it would be to be free, and to have twelve dollars a month and nothing to do. So I went over to Colonel Wood's Aleck and we talked it over behind the wood-pile, where nobody could hear us, and he told me how he knew a plenty more who would go away as soon as ever the Yankees came. He said they were fighting for us, and if we wanted to go we need not run away by night, like a poor three-hundred-dollar nigger, but we might ride off on a fine horse, in the middle of the day, and our masters could not say a word against it for fear of the Yankees. So I promised I would join him, and when we heard that General Sheridan was coming this way, with a hundred thousand men, we knew that the Confederates could not stand before him, and we agreed we would go off all together.

I remember it well; it was a dark night, but the stars were all out and the mud awfully deep, when all of a sudden Uncle Henry comes rushing in by the side gate, quite out of breath, and tells us that General Early has been beaten all to pieces, and that the Yankees are coming across the mountains. They did not know any thing of it in town, and I had heard master say at supper-table that we need not be afraid; the Yankees would again go up the Valley to Lexington and pass us by. But we knew better, and mother would have told mistress, whom she was mighty fond of, but Uncle Henry would not let her, and mother was terribly worried about it. He told us that we must all put on our Sunday clothes, and be very polite to the soldiers, because they were coming to make us all free, and we were just as good now as they. Father was very uneasy about us, for he did not believe half of what the others said, and shook his head and groaned as he sat before the fire and smoked his pipe; but he said nothing, only now and then he would look up, and when mother looked at him at the same time, he would shake his head and sigh, until it made me feel quite badly, and I did not know what to do.

At night, when the white folks had all gone to bed, we, Aleck and I, took an ash cake and a piece of middling, and we ran up the turnpike, miles and miles, until we came to the top of the long hill, where Doctor White's house stood before it was burned, and there we sat the livelong night, and watched the camp-fires against the dark mountain side, thinking what the Yankees were doing up there, and why they did not come

to help us all. It was very hard to trot back again in the morning early, and to go to work splitting wood for the cook before breakfast, but Aleck and I thought if we could but once see the bluecoats coming down the hill, and their horses standing by the side of the lake, we would be perfectly happy.

And so it did come about one fine, clear morning. On Monday a man in gray had come racing up the turnpike, looking right and left under his broad-brimmed, slouched hat, and gone into town. Uncle Henry had met him as he came up, and shook his head and said: "Now, I should not wonder if that was a real Yankee." They all laughed at him, and asked him if he did not see the Confederate gray and the ragged hat the man wore. But he shook his head and said: "Now, I'll tell you, boys, it may be so, and it may not be so; but that man there did not ride like one of our folks, and he had his eyes too busy and his hand too near his revolver to be one of our soldiers." That morning early there came two, and three, and at last a whole number of these graycoats, and somebody said in a whisper, as we were standing at the stile close to the turnpike, "Those are the Jessie Scouts, you believe me!" But we looked at the old man who said so, and as nobody knew him we did not believe him. It was all the same true; it turned out afterward that they were Jessie Scouts, as they called them from General Fremont's wife; and there had been a dozen of them in town all day long, and nobody had known them. We knew how little our soldiers cared about spies and that sort of men, and so it was not very difficult to come in and find out every thing.

But on Tuesday, early in the morning, as soon as master had had his breakfast, we all slipped out and went down to the road, where we found a great many people standing about and talking of what the Yankees were going to do with the house, and the servants, and the town itself. Down by the lake, where the road from the house comes into the turnpike, and not far from the little lodge, stood a heap of gentlemen, who had come up from town to beg pardon of the General, and to ask him not to burn them all out. They were mightily scared, and Mr. Fowler, the tailor, who is a great goose, as I have heard it said often and often, looked white and shook in all his limbs. It could not be from the cold, for although the rain had stopped overnight, it was quite mild in the morning. Alongside of them, but a little apart, stood master and some of his friends; I don't know if they had come too to ask the Yankees

to spare the house. Soon one man came flying down the hill, and then another, and then three or four together, galloping right by us without ever stopping, and just crying one after another, "They are coming! they are coming!" I slipped up close to where master stood, and I could hear them say that it was a mighty hard thing to stand there and not to know whether they would have a house over their head next night or not; and what would become of the ladies and of the little ones. One I heard say distinctly, "Oh, gentlemen, we'll all go up before night, sure enough!" William Gibbons, who preaches down in the big bath-house every Sunday, said the gentleman was very wicked, for if God would take us up we must all be ready at any time; and he, for one, was quite willing to go to heaven.

Every now and then somebody would cry out, "There they are!" and we all looked up to the top of the hill, behind which the road was hid, and when a man slowly rose over the brow and it turned out that he was on horseback, we thought sure enough there were the Yankees. So we stood hours and hours, and just when we thought they would not be coming that day, two men rode up the hill and down again slowly, then three more, then a dozen or more all in a body, with flags in their hands; and at last the whole turnpike was blue, and we knew for a certainty they were come. We just looked at one another, and I felt mighty queer; but Uncle Henry and all the others, who stood way down by the stile, looked exactly as if they were going to shout to the sky and to jump out of their skin. Aleck looked at me too, and winked, and shut his eyes, and shook all over, till I could not help myself, and I laughed, and they all laughed, and it set the others down at the stile a-laughing, and we held our sides and did not mind master and his friends looking at us as if they did not like it at all.

When the first officer came up to where Mr. Fowler stood, he rushed forward and came near falling between the horses' feet, and they all cried out together, I don't know what; but the tailor had the biggest mouth, and he talked loudest. So I suppose they heard him, and one of the officers said something about private property being spared, but public property must be given up.

Just then master walked up himself, like a real gentleman that he is, and although he was on foot and had not even a spur on his boot, he looked as good a man as the big officers on their fine horses. One of them told him he was not the General, but he would send up a guard as

soon as they got into town. Then they moved on, and such a sight! They looked very different from our poor Confederate soldiers, with their sleek horses and bright swords, and there was not a ragged jacket or a bare foot among them all. They had, every one of them, a pile of good things strapped up behind and before their saddles, and a good many had a fine horse by their side with all sorts of packages and parcels strapped upon their back, ever so high, but nobody in the saddle. But I thought, what wouldn't I give if I could but ride one of those fine horses and be a soldier and as good as any white man! I looked at Aleck, and I saw he thought so too; and what is best about it, it did not last long, and it all came true, sure enough. We stood there and looked and looked until we were tired, for there was no end to the horses, and the big guns, and the wagons, and oh, they had every thing so nice and so whole, though they were bespattered from head to foot; I did not think soldiers could look so well. At last they were nearly all gone, and I and Aleck went back.

When we came to the other side of the lake we saw Miss Mary and some of the other young ladies standing by the window up stairs, and some of them were crying; but Miss Mary waved a little flag, such as our soldiers have, right in the face of the Yankees. But master looked up and gave her such a look! Miss Mary went away from the window, and when they sent for her to come down to dinner, she told Flora to tell master she had a bad headache and did not want any dinner. Soon after the bell rang, and when I went to the front-door there stood a big Yankee officer, with his sword by his side and the mud all over him, and he asked in a very soft voice if master was at home. I did not like much his talking of my master and he a Yankee, but I knew I must be polite to strangers, and I asked him to please walk in. He said he wanted to see master, would I request him to come to the front-door for a moment. I can't tell exactly what it was, but there was something in the officer's voice, and in the way he spoke to me, that made me feel a big man, and as if nobody ought to call me Oby any more. Master is mighty good to me, but he always talks to me as if I was a little baby and had not any sense at all. Now the officer spoke right sternly, though his voice was so soft, but somehow it did not hurt me in the least, and I felt all the better for it. I ran in and told master, who came out at once, not at all flurried but like a grand old gentleman, and he begged the officer very politely to walk in. But he would not

come in, and merely told master that he was on General Sheridan's staff, and that he wished to know where he should place the guard. I wanted badly to hear what they were going to say to each other, but master sent me down stairs to tell Aunt Hannah to cook a big dinner for the soldiers. We had done that often enough when our poor Confederates came by, and there was not much left in the smoke-house; but when the folks in the kitchen heard it was for the Yankees they were going to cook they set to work with a will. Aunt Hannah said she would sit up all night to work for them blessed Yankees, and Flora laughed and cried out that she hoped there was a handsome captain coming to take her to Boston.

Now I did not like that at all, for Flora was a mighty sweet girl; she was not one of your mean black niggers, but quite light, and had the most beautiful hair I ever saw in my life, and a waist—why she could wear Miss Mary's dresses, who is not bigger than a grasshopper, and they were still too large for her. So I sat down angrily; and turned my back upon them, and whistled to myself. All of a sudden there comes a hand and shuts up my mouth, and a voice says to me: "Why, Oby, you are not at all gallant to-day!" Up I jump and make her a fine bow, and say, "Oh, Madam, I did not know you was here, I hope you are well." She did not say a word, but looked at Aunt Hannah and looked at me, and then she burst out a-laughing and cries: "Oh, Mr. Paragon, you must look sharper, or one of these days Miss Flora will bloom in another garden." They had spoilt her mightily, and told her that her name meant "Pretty Flower." The young ladies on whom she waited gave her quantities of nice things, and when she went down on Sunday to church she looked every bit as pretty as a lady, and prettier too. Colonel Wood's Aleck was very sweet on her, and he and I had had many a fight about it—who was to escort her to preaching, and who was to hand her into supper, when Aunt Betsy's daughter was married. She went more with Aleck than with me, and many is the cry I have had about it; but then she would look so sweetly at me, and say with such a soft voice: "Get along, you handsome nigger!" that I could not help myself, and all the money I ever got went to buy her ribbons and candy.

I went up to her and said: "Now, sweet angel, don't you be angry with me, and you shall have that big red shawl that hangs out at Mr. Abraham's store window;" and I put my arm around her and was just going to—when there came such a pull at the door-bell that I jumped

up and thought the Yankees were breaking into the house.

I ran up the stairs as fast as I could, and as I was trying to unlock the door—we did not use to do it, and so the key would not turn very quickly—somebody rang and rang until I got frightened out of my wits. When I opened the door there stood Miss Polly, as red as a peony, her dress all in tatters, and her hair hanging about her as I had never seen a lady do in all my life, and rushes by me to master's study. Master had just come out to see what was the matter, and she ran nearly over him. Then she began telling him to come, for God's sake, to her house; how the Yankees had come there and broken every thing to pieces, and were misbehaving shamefully. I did not believe a word of it, for they had been very polite to us all and to master too; but he did not say a word, put on his hat, gave Miss Polly his arm, and walked right off with her. I followed him, for I thought he might want me, and I heard Miss Polly rattling away like a water-mill, telling him how the soldiers had come to the house, and first broken into the kitchen and eaten all the dinner that there was, and then came into the sitting-room and asked for whisky. Her brother, who had been shot in the Valley and was lying with a broken leg on a couch, had gotten very angry and called them names. The Yankees did not like that, and went to work smashing every thing in the house. So she ran over to our house to get help.

When we crossed the road—it was knee-deep in mud—we saw Miss Emma, with her three little children, sitting on the big oak stump right by the house, crying bitterly, and in the house all the windows and doors smashed, and such a row as I have not heard in my life. Master puts Miss Polly down by her sister's side, and tells her to sit quiet, and then he walks as boldly up to where the Yankees were as if he were General Sheridan himself. I was afraid to go after him, so I staid by the ladies, who, I thought, wanted somebody to protect them, and they were so full of the misfortune they told me every thing. All the silver was gone, and all the china was broken, and the pictures cut to pieces, and the books thrown out of the window; and as they were telling me the soldiers came out. Some had a pillow-case full of flour, another a tureen filled with meal, and still another had two big gold watches in his hand. At last one came out with a silver cup in his hand. When Miss Emma sees him she jumps up and catches hold of it, and says, "You sha'n't take away my poor baby's cup!" "But I will," says

the soldier—a great big fellow with a sword by his side. “But you sha’n’t!” cries Miss Emma again, and the big tears ran down her cheeks. And there they pulled, she on one side and the gentleman on the other side, and I thought she was going to fall down, when master comes out and very quietly puts his hand upon the soldier’s arm, and says, “You will surely oblige the lady and let her have the cup.” The Yankee looked quite bewildered, but he had let go, and Miss Emma ran back to her seat with her baby in her arm; and the baby held the cup with her dumpy little fingers, as if she knew what she held, and master looked pleased and said: “I am glad, Sir, you can act so handsomely.” I thought the soldier had a great mind to tell him he did not want any of his praise; but I know most men were rather afraid of master, he looked so stiff and so stately; and he went slowly away. Then master called out in a clear, loud voice: “Mike O’Rourke! Mike O’Rourke!”

I was half frightened, when all of a sudden there stepped out from behind a big oak-tree a great red-haired Yankee, with a sword, and a carbine, and a pistol in his belt. “What do you want?” says he. Master answered, “Were you not placed here as guard, Sir, to protect this house?” “Well, I believe I was.” “And when these marauders came, and the ladies begged you to protect them, you ran away and hid?” The soldier looked as if he did not like at all being talked to in that way, and perhaps he had not a very good conscience; so he said, in a sulky tone: “I could not stop all those fellows; they were too many for me!” Master said, very quietly: “You know very well that your orders are to do your duty, and to shoot down the first one who breaks the safeguard.” The Yankee looked rather taken aback; but then he cried out very angrily, “I don’t know what all this is to you, Sir, but I would have you know that it is very hard for a man whose house has been burned over his head, down in Pennsylvania, by these beggarly rebels, and whose old father and mother have been driven out by night and ruined for life, to stand here and protect people who, for all I know, may have been the very ones to do so to me.” With that he turned on his heel and walked to the house. I don’t know what master thought; but he looked rather puzzled, and went up to Miss Emma and began talking to them in a low voice.

Soon after the Yankees made a great uproar in the house, and then they came out, one by one, the red-haired man shoving them out with a laugh and a curse, until the house was clear again. I had been watching them, so that I

did not hear what master said to the ladies, but just as the last one went down the hill I heard Miss Polly crying bitterly, and saying: “And would you believe it, Sir, one of these wretches told me I was the ugliest woman he had seen in the Confederacy; and as for Emma, she was too ugly to live?” I looked hard at master, to see what he would say to that, but I thought he was trying all he could not to laugh. Then he smiled and gave his arm to Miss Emma, and asked her when she had heard from her husband, and they all went back to the house.

The red-haired man came out and sat down on the bench in the veranda; and when he sees me standing there, he says, “Come here, man, and bring me some water; and, look here, bring me some whisky too, or I’ll cut your head off!” I was certainly afraid he would do it, too, so I ran as fast as I could to Uncle Tony close by, who I knew had some apple brandy, and telling him that it was for a Yankee soldier he gave me some. I ran back to the Irish gentleman—for I knew him to be Irish, because we have so many of those folks around us, working on the canal—and brought him the whisky. I was running for the water too, but he called after me, and said he was not thirsty now, I need not go for water. So I sat down on the grass by his side, and looked up at him, and got hold of his sword, and made the little wheels on his spurs play as fast as they would go.

All of a sudden he looks at me and says: “Hallo, Cuffee, how would you like to have a fine horse and ride along with us all?” My heart jumped when I heard him make such an offer; but I did not know if he was in earnest, so I only laughed and laughed until he could not help himself and had to laugh too. But after a while he looked very sober, and said: “Nonsense, Cuffee, nonsense; don’t laugh that way, but tell me soberly would not you like to go with me and become a soldier?” When I saw that he was really in earnest I jumped up and said, as loud as I could, “Yes, Sir, that I will, and I have long waited for the day; God be thanked it has come at last, and I shall be a free man!”

He told me then to follow him, and we went over to Burr’s Hill, where the General had his head-quarters, and the red-haired man’s regiment had their camp. When we got there I found out that he belonged to the artillery, and the whole wood was filled with guns, and wagons, and horses, and all about the hill were fires lit, and the men were sitting around them eating their supper. I felt all of a sudden as hungry as a rattlesnake, for there they had coffee, and

white sugar, and lemons, and all the good things we had not seen at our house for ever so long. We went past them all, until we came close to the house, and there I saw a great number of colored gentlemen standing around in a circle, and in the middle were some Yankee soldiers. Just as we came up I heard one of them say, "Here is another fine lot; what's the bid?" I felt as if I was turning to stone, when I found out that he held Bob, my second cousin, by his right ear, and pushed him forward in the bright light. I thought sure enough it was all the old story over again, and we were not free yet, but to be sold just as we were before. Somebody cried out, "I'll give a ham!" and another, "I bid a loaf of sugar!" Now I wondered more than ever, for Bob was a powerful fellow, and could plow better than any man on the plantation, and that was no price at all, even in Confederate money. But I soon found out that they were only offering something for the right to choose their servants, and that we were really free, only we could not choose our masters, but they chose us.

When I understood that right, I turned round and said, very politely, "Master, I wish you would not offer me to any body but keep me yourself. I would rather be your servant than any body's else." He seemed to be quite pleased at being called Master, and slapped me on the shoulder, and said, "Well, Cuffee, if you wish it, you may do so." I did not like to be called Cuffee, which is not respectable for a nigger who moves in good society; so I said, "Master, my name is Oby; and if it is the same to you, I would rather you should call me by my name." I don't think he heard me, for he said nothing for a while, and then he showed me his horse, a fine big bay, and told me to rub him down: "But mind you do it well," he said, "or you will be bucked." I did not know what he meant by that, for the boys had often called me a "Buck," and I had always taken it for a compliment. I soon found out however what it was, for Jack, the doctor's boy, who was up here too, and who had refused to cook supper for his new master, because he was so tired from doing all they had made him do ever since dinner-time, lay not far off, bound up in the most curious way I have ever seen, and was hollowing most awfully.

My bay did not give me much trouble, only he had an ugly way of kicking, when you touched him at a particular spot; and he was so quick at it that I got one or two kicks against my shins before I was aware of it. I disliked it mightily, for I did not know then that his kicking was to

save my life when nothing else could help me. They did not offer me any supper that night, so I ran home and told Flora all about it, how the soldiers said I was free now, and how I was to have a fine horse and become a sure enough soldier, and have my fifteen dollars a month, all to myself.

She was not half as glad as I thought she would be, and asked me if I thought it was better to be the servant of a Yankee than to serve a gentleman like master. I did not like her saying so at all, for I could not tell her why I liked it better; and still, I knew it *was* better. I had thought I would ask her to come along with me and become my wife, when we got to the North. But somehow I had not the courage, she looked so wicked out of her eyes; and then Aunt Hannah stood by, and although she made-believe she was busy with her pots and plates I knew she had heard every word I said. But I could not help looking at Flora, and just to say, "Oh, Miss Flora!" and I thought she looked as sweet as a rose-bud, when she cast her eyes down and picked at the pretty belt I had given her the Sunday before, and seemed to think very hard.

Just then Aleck came up, and asked me when I was going away. That put me in mind, that last week master had called us all up into the hall and told us, if we wanted to go when the Yankees came, we must be sure not to sneak off like a parcel of runaway niggers, but to come up like men and tell him, and he would see to it that we had some clothes and something to help us on the way when we went. I thought it was my duty to go up stairs and tell him that I had made up my mind to leave. I pulled off my shoes and went up softly into the veranda, where I knew he would be sitting. And so he was, in his old arm-chair, with Maida right across his feet and Miss Lucy sitting by his side, reading to him out of the big old Bible he uses at prayers, when we come up in the morning and the evening. She read so low I could not hear where she was, but I made out that it was something about God being our rock and a very present help in trouble; and when I looked at master I saw the big tears were coming down his white cheeks slowly, one by one. I knew then he was thinking of young master, who lay dead and killed way off in Spottsylvania, and nobody knew where. When I saw that I could not go up to him to save my life, so I slipped down again, and did not know what to do.

Master had always been mighty good to me, and I had never wanted any thing on this earth but he had given it to me; and I knew as long

as I staid with him, and he had any thing to live on, he would provide for me. But I wanted badly to be a free man, and I knew I could never earn fifteen dollars a month, as I could at the North; and perhaps they were going to give us each a farm, and we would not have to work any more. It was a bad night for me, and my head turned all around in a whirl; now I wanted to stay, and now I wanted to go. But when the red streaks came out over the mountain, and then the big sun rose right behind the old cherry-tree at the tobacco patch, I remembered what William had said, when he preached to us at Uncle James's funeral, about the rising of the Sun of Liberty, and our going to glory here upon earth, by the word of Mr. Lincoln, and I ran as fast as I could to Burr's Hill, and told them all that I had come to be free.

My new master showed me a beautiful horse that I was to ride, and when the light came through the trees and I could see every thing clear, I saw it was Master William's great big stallion. I did not like to get on him, because every body about here knew him, he had stood so often down in town, but I was told to take him down to water, and I did not like to be bucked like Bob. I went down to the spring, and I could not help thinking he was the handsomest horse I had ever laid eyes on, and it would be a great thing for me to ride alongside of all the gentlemen on such a fine horse. When I came back to the fire they showed me a quantity of bags and bales, all nicely fixed in white cotton sheets, which I had to strap on the horse; there was just enough room left between the pile in front and the pile behind to get into the saddle. They did not give me any breakfast either, but I did not mind that much, for soon the bugles sounded—it made me feel like a gentleman to be called by a bugle like all the others; and my new master, who was a corporal or a major, had some other gentlemen under him, and when the guns were all ranged in beautiful order, the Colonel came out and looked at us, and off we marched with the music at our head.

First came the Colonel and some officers, then came the music, with all sorts of instruments such as I had never seen before; after them came men who bore a number of flags, which I knew nothing of, and after them, before all the regiment, came we colored people, about fifty of us, all on fine horses, and the happiest boys ever you saw in your life. It was glorious. But when we got to the corner by the tobacco-house, where the gate has been out of order for many years and the lane is quite low

and narrow, they all stopped and we could not go any farther. The mud was awful, and the horses could not pull the heavy guns and the wagons.

Just then who must come up but master. I felt mighty badly, but I could not run away, and I looked for my new master to stand by me and let them all know that I was free. When master's eye came slowly down the line and at last fell right upon me, I thought I was going to sink into the ground. It made me feel sick. When I looked up again he was making his way through the horses and the cannons right up to me, and did not mind the mud, and the way the soldiers all looked at him, and the horses that wanted to kick him. When he came up to where I sat on my horse, he just said, "Oh, Oby!" and before I knew what I was doing, I was out of the saddle and standing right before him, with my new cap in my hand. He said, in his quiet way, "Oby, you know you are not strong enough to sleep out in the open air; you have not even a blanket, and it is not three weeks since you were sick with pneumonia. Come home, my boy, and don't distress your father and your mother. You know it will kill them!"

I knew that what he said was but too true; but then again, when I looked at the fine horse I was on, and all the gentlemen around me, I felt quite undecided. Master said again, very quietly, "Come home, Oby!" and I followed him, I did not know why. But just as we were getting out of the crowd, on the side of the road, my new master came dashing up to where we were, and with a terrible oath told me to mount my horse and be ready to start. I was so frightened I did not know what to do. Master never said a word, but just looked at me as if he pitied me from the bottom of his heart, and I could not stand that; I did not think of father and mother at home, nor of Flora, nor of the nice times we had had together in the fields at night, but I just looked at master and went away with him. But the soldier was not satisfied yet; he came straight up to us, and swearing worse than ever, he said to master, "How dare you, Sir, force that man away? Do you not know that he is free, and has a right to go where he will?" Master changed color; I knew he was not accustomed to be spoken to in that way, and I wished I had never thought of enlisting as a soldier. But he said nothing at all, and although the soldiers all turned around, and my new master pulled out his carbine and cocked it, he made his way between the horses and the guns, I following him close by, until we came out on the

other side of the column, and then he said very quietly, "Now, Oby, go home and tell your father not to distress himself about you any farther." I was just running up the road, when I heard somebody galloping up, and as I turned round I saw it was a great officer, with a sword in his hand, who rode up to master and asked him what was the matter. I could not hear his answer, but the officer said, "We do not force servants to go with us, and if your boy wants to stay, let him stay."

When I came home I found father and mother, Uncle Henry, and all of them in mother's room, and when they saw me they all cried out, "Oh, Oby, what have you been doing?" Well, it made me right angry to be treated thus like a baby, and I went out into the yard. There stood Flora, and what must she do but come up to me in the prettiest way of the world and drop me a little courtesy, and say in a little lisping way, "Oho, Mr. Paragon, you had not the courage to go with your friends? Don't you look like a little whipped boy? Shall I ask Miss Lucy for some candy for you?" It made me mad to hear her talk so, when she had all the time been telling me that I ought to stay, and not run away like the poor stupid field-hands.

I turned round without looking at her, and ran over to Uncle Bob, to ask him what I ought to do. He was not in, but Aunt Betsy was there, with the children about her, packing up all her things. I wondered what she was doing, but she would not give me any answer, and I was too mad to go home again; so I staid and waited for Uncle Bob to come home again. They had some nice middlings that day, and goody-bread with the sweetest cracklings I ever ate, and we all laughed, and talked, and I danced a jig for Aunt Betsy, and others came in until the house was full.

Late in the evening Uncle Bob came home, and such a sight he was! He had a double harness hanging over his shoulders, and a saddle on his head, and his hands full of bags and satchels, and a big gun under his arm. He looked very tired, and threw it all down; then he opened the door again and laughed, and when we went out there to see what it was, we found a nice carryall and two good, strong horses fastened to the fence. I knew the carriage well; it belonged to old Miss Mary Fitch, and the horses were Uncle Bob's master's. I did not like his goings on much, but he was an old man and I had no right to say any thing to him. When he had had his supper he lit his pipe and looked around him, and when he noticed me he opened his

eyes wide, and said, "Why, Oby, I thought you had gone with the Yankees!" I felt mightily ashamed. I had to tell him all about it, and when I had done he called me out and whispered to me, "Now, look here, Oby, don't you make a fool of yourself, but come along with me to-night and be a man." He talked and talked, and before I knew exactly how it was, I had promised to go with him. He had a way about him that few could resist, and when he wanted you to do any thing he was sure to get you to do it.

It was a dark night, the moon was behind the clouds, and at times you could not see the hand before your eyes. Uncle Bob had hitched up and put Aunt Betsy and the four children inside the carryall; he sat on the box, and every corner behind and before was stuffed full with bags and parcels. I do not know why they took so much; but Aunt Betsy would take every thing; and there was her spinning-wheel, and her split-bottomed rocking-chair, and the cradle for the baby. Then there was Colonel Wood's Aleck, and Dr. White's Jimmy, and I. We walked pretty fast, and listened with all our might, for we thought we might meet some gentleman and he might stop us. But there was nobody about that night; every body was afraid of the Yankees, and kept very close. Besides, the roads were awful, and Uncle Bob's horses could hardly pull the carryall at a snail's pace. Every now and then they would stick fast in the mud, and then we had to take rails from the fence and put them under the wheels and help Uncle Bob. It was not half as pleasant as riding on a fine horse among a crowd of gentlemen, or even sitting at home in mother's room and having a nice supper. After a while Uncle Bob became angry, and the next time the horses stalled he pitched Aunt Betsy's wheel into the road; then went the chair, and the cradle, and a great many other things. Aunt Betsy did not dare say a word, but she groaned and groaned. It sounded awful in the dark night and in the black woods where we were. At last we could not get any further, and just then we saw a light through the trees, and when we whipped the horses on both sides to get nearer to it we found an army wagon in the middle of the road, with the mud over the hubs of the wheels, and one of the mules half-dead and half-buried in the mud. The drivers and some of the escort had made a roaring fire in the woods, and we joined them. I was so sleepy I fell down where we stopped, and did not know what happened any more.

I was just dreaming of my young master's

calling me to saddle his pony when somebody touched me on the shoulder. I could not wake up at once. It always went hard with me to wake in the morning, and then I heard somebody call my name. It sounded very sweet to me somehow, though I did not know where it came from, and when I got my eyes open at last I thought I was dreaming still. For there was Flora standing by my side, looking up at the top of the tree, as if she did not know I was lying right before her. After a while she turned her eyes all around her, and when they came back to me she cried out, "Why, Oby, if that is not you! Where on earth do you come from?" Now that was a nice question to ask me; so I just jumped up and laughed heartily; and then she began laughing too, and before I knew what I was doing my arm was round her waist and I had kissed her twice. She pretended to be very angry, but I only laughed the more, and at last she told me how she had heard from Uncle Bob's son, who stays at master's mill, that I had gone along with him. Then she had made a little bundle of her nicest clothes and had followed us all the way, never saying a word, until she felt so cold in the morning she could not stay away any longer from the fire. When I asked her what she had come for, she said: "You would not have me let Aunt Betsy go away with all those babies and no one to take care of them? And then, might not somebody have come and frightened Mr. Paragon out of his wits and sent him home again crying?" At first I did not know how to take her, but there was something funny in her voice that I knew well enough from of old. So I jumped up, as quick as a squirrel, and before she knew what was coming I had my arms around her once more, and kissed her as hard as I could. We must have made some noise, for all of a sudden there was a crowd around us, and all cried out upon Flora and wanted to know how she got there and what she came for.

We were still talking and laughing in the jolliest way, as if there was no trouble in the world, and we were down at a corn-shucking, when bang went a shot, and another, and before we knew what was coming the wood was full of smoke that could not get out fast enough through the branches of the pine-trees. We all stood still, and my heart beat fast enough, not that I was much afraid of the shooting, but I thought it might be the gray-jackets, and if they should catch us and carry us back! I would not have minded the going back so much, for I knew they would not have punished us, but I could not have stood before master and seen him look at

me again, as he did when he wanted me to come home with him from among the artillerymen. I did not stand long idly there, but I just took Flora's hand and told her to come along, and then I pitched Aunt Betsy and the little ones into the carryall, and all the bundles I could find. I was as in a dream, but it was not long before the horses were put in, and Uncle Bob was cracking his whip, and we were running after them as fast as we could.

When we were a little more quiet again we looked around, and then we found out that we had left our friends the Yankees, and were quite alone by ourselves. There were about five or six colored ladies with us, some of them had babies on one arm and a big pile of clothes and such things under the other; then there were one or two elderly men who looked scared and did not know, I believe, what they were doing, except that they must go on, on until they got to the North; and lastly, there were three or four little children who were just running along with the rest of them for the fun. After a while I began to feel hungry, and when I looked at Flora in the bright daylight I thought she looked hungry too; at all events she was very pale and drooping, and I saw she had no shoes on, and could hardly walk. I went to help her, but she tried to hold up, and said it did not matter. I saw, though, it would matter pretty soon, for we had not a mouthful of bread nor meal among us, and, except Uncle Bob, who was rich enough, there was not one among us who had any money. And here we were alone, left by our natural friends and protectors, and not likely to be received on any plantation.

It seemed that all of our party felt the same way, for no one said a word. Every now and then one of the children would begin to whine and be told to hush up. Then some girl would laugh right out and suddenly stop short, as if she was frightened at the sound of her own voice. Uncle Bob, who knew best, had his hands full to drive his tired horses and to pull the carryall, with its heavy load, through the awfully bad roads. I walked steadily on, Flora right behind me, Indian file, and what with the cold, drizzling rain, wetting us to the skin, and the loads of mud that stuck to our feet, and the heavy thoughts that weighed on our minds, we did not make a very merry couple. I thought, every now and then, what a glorious time I would have at the North. I knew I could make as good a shoe as any white man, and I thought of a nice little shop I might have in Cincinnati, where Peter Hite went when he was made free, and of Flora being my good wife, really married,

and the beautiful things I was going to buy for her, so that she might look a real lady. But in the midst of my thoughts I stumbled against a big, old root, or Flora sighed behind me, and then coughed a little to put me on a false track, or asked me some question, to show that she was not sad at all, and my dreams were gone in a moment, and I saw all our troubles clear before me again.

We tramped on until late in the evening, when we met an old field-hand, with a bag of potatoes on his back, who told us we were still eight miles from the canal, and that he had seen no Yankees any where. We asked him to let us have his potatoes, but he said he did not want to have any thing to do with runaway niggers, and was going away to leave us, when Uncle Bob came up and asked him what he would take for them in greenbacks. When he heard us speak of greenbacks he became very polite at once, and sold them for ninepence to Uncle Bob, who made him promise to bring some fat middling and some corn-meal up to the old tobacco house, where we meant to spend the night. We all went in there, and it was a nice enough place for us to get dry in; there was some hay in a lean-to on one side, and I made a nice little bed for Flora; but we did not dare make a large fire for fear they might see it at the house and send the overseer down to turn us out. Uncle Bob got his middling, and Aunt Betsy cooked all they had for herself and her children, asking me and Flora to come up and help ourselves. I did not like much going there, when there were so many others who had nothing at all to eat, but Uncle Bob told me to make no hesitation—he always loved big words—and to partake of his victuals. I took Flora by the hand and pulled her along with me to the fire. Aunt Betsy looked at us, and I thought she was going to have a hearty laugh, but somehow there was none of us that night could laugh heartily, and we ate just to satisfy our hunger, but it did not taste good. Then we had a chew of tobacco, and Uncle Bob proposed we should sing a psalm about the mansions in the sky, and hallelujah, but we broke down pretty soon, and then we all lay down, one here, one there, as we were sitting. I was tired enough, but I could not sleep; the thoughts would come into my head. I could not drive father and mother out of my head, and every time I saw them in my mind they looked so sad it made me feel very badly. Then the children cried and moaned and asked for something to eat; and some of the old ones groaned too, and cried out: "O Lord, O Lord a-mercy!"—it was very hard to hear it all

and not be able to help them in any way. So I was right glad when the mist broke in the morning and the sun rose, first red, like blood, and looking as if it were angry at us, and then clear and bright, like the dayspring from on high.

I ran down to the spring, where there was a plenty of water, to wash, and when I came back I saw Flora talking very anxiously to Aunt Betsy. They hushed up when I came near, but I could see well enough that Flora had been crying, and that somebody had given her an old pair of shoes that were twice as big as her feet. She did not have big splash-feet, like a field-hand nigger woman, but hers were nice enough for any white lady. I felt mighty sorry for her; she was not accustomed at all to rough work, and down at home she had hardly ever been sent out of the house. I knew she could not stand it long, and I was determined to make her go back. I did not mean to speak to her directly. I knew she would not listen to me if she once had made up her mind; but I thought she would mind what Aunt Betsy would say to her. I took the old lady aside, and told her all about my fears and troubles, and she promised at once to talk to Flora and to persuade her to go home again.

I went behind the big oak-tree, lest she should see me, and I noticed Aunt Betsy going up to her and talking to her very friendly and very soberly. But I must have been too curious, for no sooner had she ended than Flora comes straight up to where I stood and said: "And of all men, Oby, that you should want me to go back!" and with that she broke out into such sobs and sighs that I did not know what to do, and just had to beg her to stay and to go along with us. I told her I would stand by her as long as I was alive, and she could trust me now and forever. In the meantime they had all gotten ready to start, and as there was not much over from last night for breakfast, we were soon on the tramp again.

It was an awful time, though, we had; the road was worse than ever, for Sheridan's men had been right ahead of us, and they had trampled the mud knee-deep, and if the carryall once got into the ruts the army wagons had made, there was hardly any way to get it out again. We were soon left behind, for we had to pull the horses out when they stuck fast, and to mend the harness, that was all the time breaking, and take the rails from the fence and pry the carriage up to let the poor starved horses pull it out again.

At last we came to a sandy stretch in the pine woods, where it was a little better, and as

we turned round a corner, there, right in the fence, lay Aunt Phoebe, and by her side two of her little babies, the one three years old and the other about nine months, and never a word did any one of them say. I went up to Aunt Phoebe and shook her, and asked her what was the matter. At first she would not answer at all; at last, when Flora came up and whispered into her ear, and begged her to speak to her, she said, very faintly, that she could not possibly go a step further, and that she had not a drop of milk left for her baby. Aunt Betsy came down too, and when she saw what was the matter, and turned the children round and found them look ashy pale, she called for Uncle Bob and fell to crying bitterly. He came up slowly, and looked at them all without saying a word. Then he pulled the mother and the children together into the fence-corner and put a quarter, a silver quarter, into the hands of Aunt Phoebe and left her there. We all followed him back to the carryall with our hearts ever so heavy, but what could we do? I asked Uncle Bob if he thought she would die? He did not look at me at all, but just said in his beard, "I don't know; maybe she will, maybe she won't; perhaps it's better for her to die than to live on as she has done."

After that we were sadder than ever before. Poor Flora lost her big shoes every other step, and most of the ladies had to throw away their bundles, and even then they could hardly get along. Whenever we met a colored man we asked him how far it still was to the canal, for we knew we would meet the Yankees there sure enough, and they would not let us starve, but give us all rations. It seemed as if we were never getting nearer to it, for every time we asked it was still some four or five miles, maybe six. We met some white gentlemen, too, on the road, but they just looked at us with stern faces and rode by. Once we came to a little bit of a house by the way-side, and saw an old lady sitting by the door, with a cat lapping up the milk in a gourd she held on her lap. I could not stand seeing that, so I walk up to her and make her a polite bow, and say, "Oh, Missis, I see you are a mighty good lady, won't you be so kind as to give me a little of that milk for a poor girl who is half dead over yonder?" The old lady looked at me and then at Flora, who was standing at the gate, staring with her big eyes at the gourd as if she had never seen milk in her life. After a while she said, "Well, I don't care; take it if you want it." I was just taking the gourd by the handle, being careful not to spill a drop, when a great big man in a gray uniform and a large revolver in his hand comes

out of the passage, and swearing at me, as they did in the army, says, "Now, you rascal, you clear out here or I'll shoot you down like a dog!" I felt so mad I would have liked to run up to him and snatch the pistol out of his hand and shoot him myself; but I did not have the courage, that is the truth of it, and I knew also I must not get my friends into trouble before we got to the soldiers again. When I came back to where Flora stood I saw she had dropped down upon a big rock they used to get on horseback by, and when I spoke to her she said she could not get any further. That finished me, and I swore to God Almighty I would have something for her or take a man's life. But just then something came between me and her, and when I looked up there was the old lady with the gourd in her hand and a piece of corn-bread I had not seen before, and she said: "Never mind my son, boy; he is in bad humor because all our servants have left us in a body yesterday and taken our horses with them. Poor child, what is the matter with her?" And then she took Flora's hand in hers and rubbed it, and told her to sit up and eat and not to cry any more. I talked to her too, and after a while she did set up, and the way the milk and the bread went! It would have been a pleasure to me to see how she enjoyed it; but I was terribly hungry myself, and I counted every mouthful she took and every gulp that went down. When she had done, she stood up and looked much better, and then she thanked the old lady, as she had learned to do from Miss Lucy. The old lady had big tears in her eyes and looked mighty sad; she said something about God's Providence, which I did not understand, and about somebody's being ground between the upper and the nether millstone, which, I think, is somewhere in the Bible.

We had to walk fast enough to overtake the others, who had gotten far ahead of us, and it was late in the evening when we saw them all standing in a crowd together on a high place. The sun was just about setting, and the sky was golden, and as we looked at them we could see every ray of their clothes and every hair on their head. They all talked very loud, even Uncle Bob, who seemed to be very angry. We came up slowly, for we were terribly tired, and Flora could hardly drag one foot after the other. When we came up to where they stood, we saw we were on the side of the canal, and there on the tow-path sat Aunt Hannah, crying and screaming all together, and the others stood around her and looked as angry as could be. We pressed close up to Aunt Betsy, and I asked her in a whisper what was the matter. "Oh,

Oby!" she said, "just think of it, Aunt Hannah was the first to see the canal, and she walks right up to where we now are and takes her poor little baby—it was not more than two months old—and before we knew what she was about she had thrown it into the water, and there it lies now. Oh, Oby, these are awful times! God have mercy upon us!"

I could not say a word. I had never seen or heard of such misery in my life. Flora went quietly down to where Aunt Hannah was rocking herself, weeping like a child, and then screaming out aloud, and sat down by her and tried to take her hands and to soothe her. But Aunt Hannah would not be soothed; she cried out: "Leave me alone, you! leave me alone! You don't know what it is to have a baby and to see it die on your breast. She is happier down there than she could ever have been in this world. I only wished I was there too. Can't you leave me alone? or give me something to eat? I have not eaten any thing since day before yesterday, not a mouthful. Oh, my baby, my baby! She was the sweetest child I ever had!" And with that she began screaming again, as if she were distracted. I could not stand it any longer; so I touched Flora and told her to come along, Uncle Bob was going and we must try to get something ourselves, or we would be starved too, or get mad like poor Aunt Hannah.

Flora got up and followed me, but she did not say a word. The tears were just running down her cheeks, and she did not mind it in the least. Uncle Bob was driving along on the tow-path, and we all followed in a long string, very slowly. At last we came to another turn, and there, right before us, lay a big mill, and behind it the town. On the mill-race stood a soldier in blue, and I could have shouted aloud, for now I knew our troubles would surely be at an end. I do not know what made me so bold, but I walked right up to the soldier and asked him if he did not know somebody that wanted a really good servant. He looked at me and then at Flora, who was standing behind me, and said: "You mean two good servants, don't you? I can't afford keeping a servant, but there is the sutler; I heard him inquire a little while ago for a handy fellow, who understood horses and knew how to make coffee and such things."

I hardly let him finish, for that was exactly what I was good for, and Flora made beautiful coffee. I just asked him where the sutler was, and when he showed me some way down the street a splendid team of four gray mules, standing before a large, fine house, and said that was the sutler's wagon, I took hold of Flora's hand and ran down as fast as I could. But when I came between the mules and the house I saw a whole crowd of servants standing around the door and crying out: "Take me, master, take me!" I thought it was all over, and I had lost my first and last chance, when Flora suddenly let go my hand and fell down like a log of wood, right between the wheels of the wagon. I tried to lift her up, but there was such a crowd, and the mules began to kick, and I thought she was going to die right away. Just then a man who had been inside the wagon popped his head out, and seeing Flora lying there, he asked: "Hallo, what is the matter, my man?" I told him as well as I could, and begged him for mercy's sake to help me, for Flora was sure enough dying. He laughed and stepped down leisurely over the swingle-trees, with a piece of hard tack in one hand and a bottle in the other. He poured some out of the bottle into his hand and rubbed her head with it, then he poured some down between her teeth, and when I could see next, she was sitting up with her head leaning against the wheel, opening her eyes as if she had been fast asleep, and munching a little bread in her mouth. I thanked the gentleman for having saved her life, but he only laughed the more. Then he asked me if I was not hungry too; and before I could say a word he pushed a whole pile of crackers into my hands. When Flora was all right again, he asked us what we were going to do with ourselves, and we told him as fast as we could, for we were both mighty grateful to him for his kindness. Then he told us that he was the sutler himself, and that if we promised to do well and be faithful servants to him he might find something to do for us both. He called to his clerk, who was in the house, and told him to see to it that we got a place to sleep in and some supper. When I looked a little around me I saw they had a beautiful flag flying from the top of the house, and that was the first night I slept under the Stars and Stripes, a free man.

THE CENTURY MAGAZINE — FEBRUARY, 1890

HOW SAL CAME THROUGH

BY THE AUTHOR OF "TWO RUNAWAYS," ETC.



HE summer sun balanced itself so evenly over Holly Bluff plantation that the broad white dwelling cast no shadow. But there was shade for all that, great stretches of it where, between the road that curved around the house and the fields now wreathed in tranquil cotton bloom, the pines had been left to check the western winds; and along the edge of the ravine too, where stood the cabins, were cool Rembrandt shadows, into which the open doorways looked out pleasantly, the colors of sundry and varied garments strung along the lines that linked the spreading oaks lending cheerfulness to the scene.

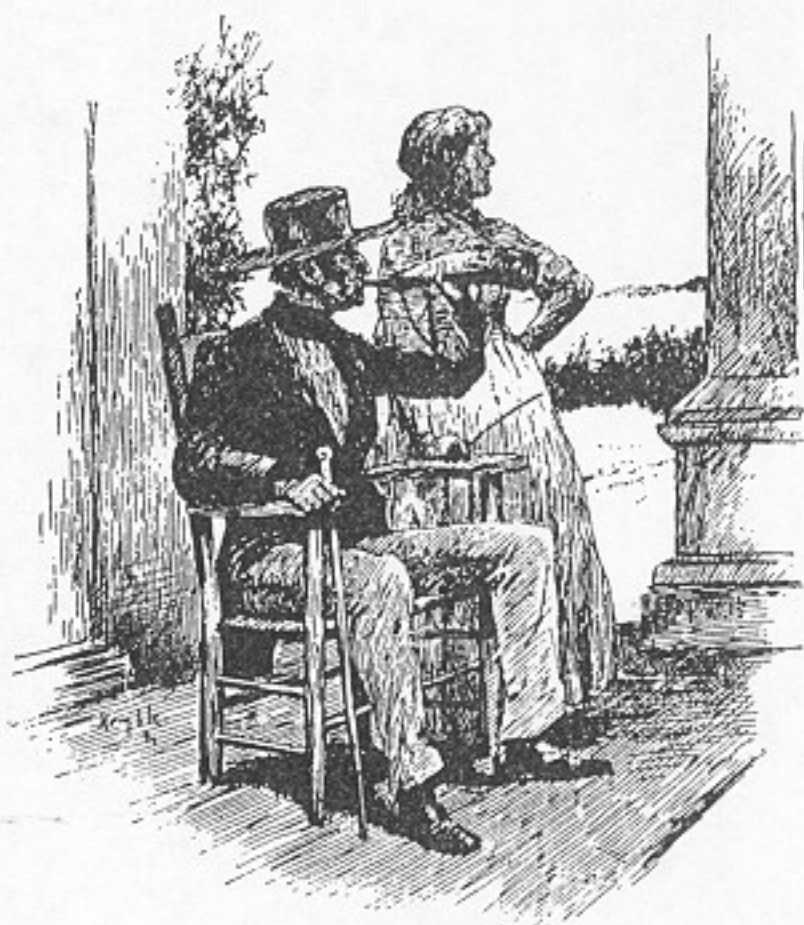
And there was a deep, cool shade in the broad back porch overlooking the blooming field, whose thousand acres ran off under the

tremulous heat to the varied green of the creek bottom, beyond which the bold ridge with its one hue rose abruptly and checked the vision.

Perhaps it was this fine restful background a mile away, boldly defying the swamp on the right but extending like a miniature mountain range in lessening knobs on the left, that made the back porch old Colonel Tom Broome's favorite spot; perhaps the fact that it overlooked the whole plantation and the broad back yard had more to do with it. Anyway he had sat there for forty or fifty years, when he had time to sit, and there his black hair had grown thin and gray, his dark smooth face wrinkled, and his erect form somewhat bent. And here he sat this day nodding in the noon, his pipe fallen to the floor, his glasses slipping from his nose. The erect and defiant rooster came up the steps deliberately, surveyed him with scorn, and began to pick about him with a great show of discovery, calling to his more cautious family, which waited silently at the foot of the steps. The colonel's heavy walking-stick slipped from his side and fell to the floor; the scornful rooster sprang ten feet into the air from the porch, and as he came down excitedly related to the startled family his hairbreadth escape from an imminent deadly trap set for him. Awakened by the disturbance, the old gentleman straightened up in his chair and would probably have soon drifted again into the familiar currents that lead down to repose, but at that moment a young girl stood beside him.

"Grandpa," she said, "here 's your julep." She bore a large goblet, from which and from the ruby lake it held rose a little forest of mint. "I know it is cool, for I drew the water from the north side of the well myself." Her blue eyes smiled upon him as she stood waiting.

The colonel gave her smile for smile as he took the glass. His own eyes were blue, and they softened the fine, stern face wonderfully.



ON THE PORCH.

He lifted the julep gallantly with mock formality, saying, "Your health, young lady!" As he sipped and drank, the girl laughed softly and recovered his pipe, which she proceeded to fill again, he watching her the while. Her dress was a simple one of some soft white material, with a bit of blue ribbon at the throat, and a bit to hold her sunny hair back from her face. The experience of the moment was an everyday one with them; the girl knew that presently he would blow the dinner horn, smoke his pipe, go in to dinner, return to the chair, smoke and nod again, and finally make his way to the cool East India lounge in the hall, where she would sit fanning him while she read or dreamed the fair sweet dreams of girlhood. This was the midday programme.

To-day she saved him the exertion of rising, by standing on tiptoe, and fishing the carved horn off its hook with the long stem of his pipe. He fixed his eyes upon the far ridge, fitted the mouthpiece to his thin lips, breathed into the instrument, and the mellow call leaped forth across the brooding field. As it soared above them, "Too-oo-oo-oot-oot-oot-oot-oo-oo-oot-oot-oot-oot-oo-oot," the distant negroes let fall their hoe handles, and the plow mules halted abruptly in their tracks. The great ridge gave back mellow echoes, and down the creek bottom into the far swamp a merry hundred fading calls hurried out of hearing. And as silence swallowed them all, July, the aged hound, came out from under the kitchen and stood for a moment gazing thoughtfully with his dim wistful eyes into his master's face, then turned again to seek the cool earth bed. So had he come for years; so would he continue to come as long as his stiffening limbs could bear him, stirred by faint memories and fainter hopes.

As the girl tossed the horn back to its peg the colonel said:

"Now, sweetheart, what's that about your drawing water?"

She smiled into his face again.

"I said I drew it from the north side of the well. You know there is always a lizard that stays on that side and keeps it cool there."

"So I have heard," he replied with gravity.

"Let me see those hands." She held out one tiny palm reddened by its exercise with the rope, and he took it in both of his, examining it closely.

"Why did n't you make Sal draw it? You must n't spoil this little hand with such work."

"Well, Grandpa, Sal is out of humor these days, and it is more trouble to make her do anything than to do it for her. I don't think she is quite well," she added quickly, seeing the slight frown upon her grandfather's brow. At that moment a short, thick-set girl came from the kitchen and started for the house. She had a round black face, the thick African lips, an enormous foot, and walked with a peculiar vim that suggested plenty of muscle. Black as was her face naturally, it was darkened by a sullen look that overhung it. The colonel stopped her.

"What's the matter with you here of late, Sal?" he asked gravely. "You leave others to do your work. What are you moping about?"

The girl stood silent, picking at her apron. Her young mistress interposed quickly, her womanly instinct half divining the cause.

"Has Alec left you, Sal?"

"Alec been conjured," said Sal, after a long pause.

"By whom?"

All the pent-up wrath came rushing out.

"Dat yellor huzzy, M'ria. She done move ole Miss ter gi' 'er dat frock she promus' me, an' she conjured Alec tell he gone plum crazy 'bout her. Hit's church-dis Sunday an' church dat Sunday, an' dance, an' carry on f'om one day's en' ter 'nother. Ef ever I git my han's on 'er, she goin' ter know who she foolin' wid—"

"Hush!" the colonel spoke sharply.

"Ole Massa, you doan' know dat nigger. She de 'ceivines' huzzy on de place—lie, an' steal—"

"Hush, I tell you! This stuff must end right here. You go now and attend to your work. If I hear anything more of it, I'll send you to the field."

"No, Grandpa, Sal shall not go to the field. She belongs to me, and I want her at the house." The young lady spoke with energy and emphasis, and Colonel Broome settled back in his chair and proceeded to light his pipe. He

was a slave himself sometimes.

"Now, Sal, you come to my room; I want to talk to you." The little lady marched in, and her air was that of an empress. "Sal," she said sternly, when they were alone, "don't you know it is wicked to talk as you do? Suppose you were to die to-day with all that hate in your heart, where do you reckon you would go? Straight down to the—the—devil; straight down like—like a bucket falling in the well." Her voice sank into an awful whisper.

"But, Missy, dat nigger —"

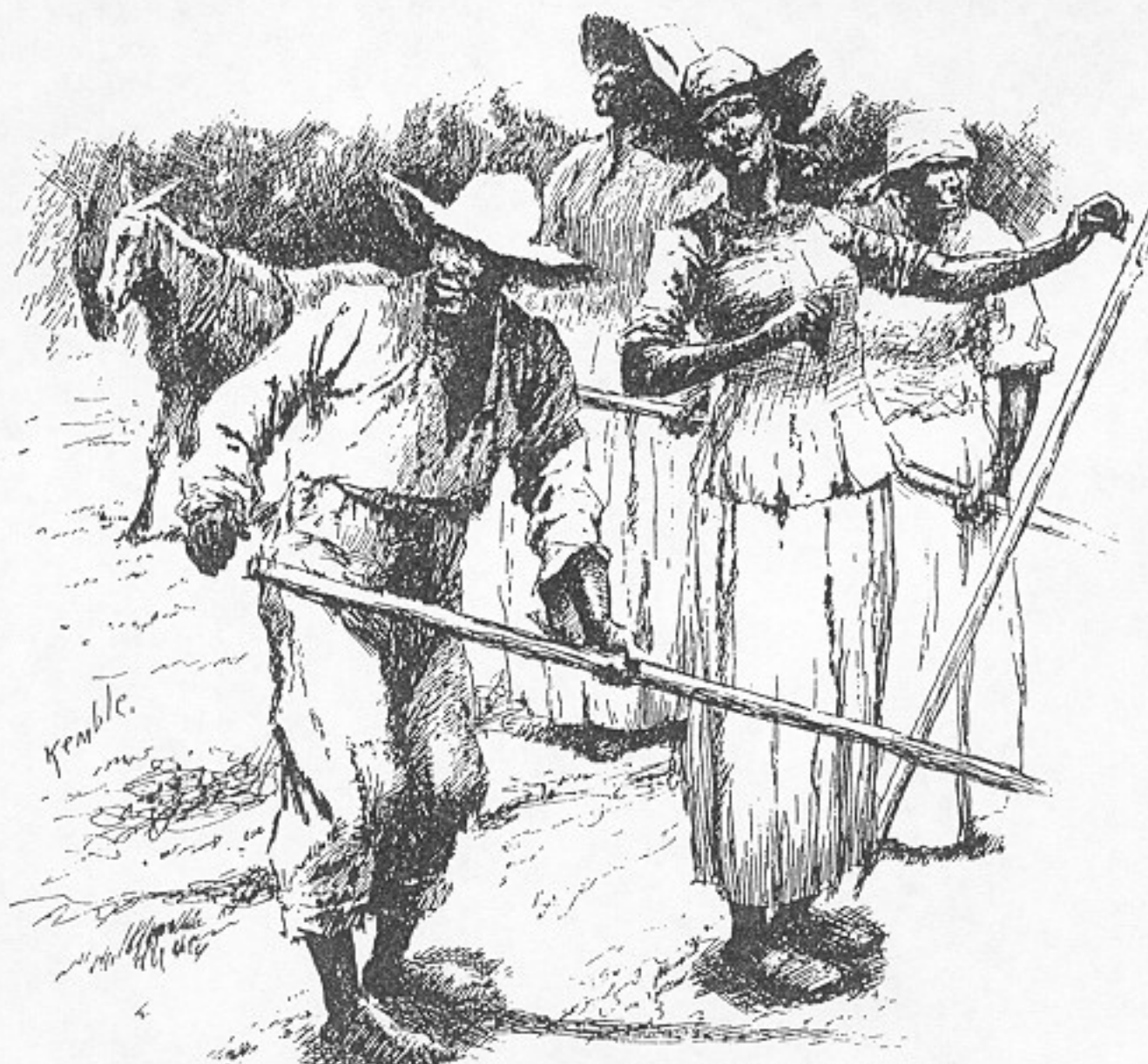
"Hush your mouth! Don't you 'but' me! I say you would go straight down to him, where you ought to go! Are n't you ashamed—d of yourself, are n't you ashamed—d! What am I to do with you, I'd like to know? I have read you the Bible, and taught you how to pray, and you get worse and worse every year. Get down on your poor, sinful knees, and ask the Lord to forgive you before he strikes you dead!" Sal dropped down on her knees, and put her face in her hands while her mistress remained standing, lining out the petition to the throne of grace.

"O Lord, look down on me, a miserable sinner!—I am *desperately* wicked!—I am full of hate!—I lie!—I steal!—"

"No, I doan' steal, Missy!"

"Yes, you do; you stole my ribbon! Say it: 'I steal!—I ain't fit to be with decent people!—I ought to be hoeing in the field!—And have forty lashes! O Lord, forgive me—as I forgive my enemies! As I forgive M'ria!'"

"Can't do dat, Missy!"



"THE DISTANT NEGROES LET FALL THEIR HOE HANDLES."

"Yes, you can; you *shall*. Say it: 'As I forgive even M'ria!'"

"Can't do hit, Missy, can't do hit; not tell I git my han's on 'er wunst."

"But you shall!—'As I forgive even M'ria!'"

"Lah, Missy, look at de dirt on yo' new frock!"

"Sal, are you going to mind me, or must I have you sent back to the field?"

"As I fo'give even M'ria," said Sal, meekly.

"And, O Lord, make me a good girl!—For Christ's sake!—Amen!" Sal's conclusion was positively cheerful, and she rose with alacrity.

"Now, Sal," said Missy, gently, her eyes resting pleadingly on the other's face, "I want you to promise me that you will go to prayer-meeting Sunday night and try to get religion; won't you, Sal—for me?" It was an old subject between them. "If you will, I tell you what I'll do: I'll get you a better dress than M'ria's; I will."

"Sho 'nough, Missy?"

"Sure enough. If you genuinely get religion. I know it is n't exactly right to hire people to do that; but if you get it, it does n't

make much difference at last. O Sal, I do so want you to be good! Go to prayer-meeting Sunday night and ask the Lord to help you, won't you, Sal? — just for my sake this time?"

The two girls were about the same age, and foster sisters. The earnestness in Missy's voice made Sal serious at last.

"I will, Missy," she said. "I goin' ter do my bes', an' ef you hear me er-singin' when I come erlong back by heah, hit 's all right. Goin' ter git me er red frock, Missy?"

The dinner bell rang and the girl darted off with a face full of smiles; or rather with a face full of a smile, for Sal's smile involved everything in its neighborhood when given full play.

II.

THE road that wound around the pines and into the woodland a quarter of a mile away, where stood the little log plantation church, lay with the tranquil shadows printed darkly upon it by the full moon as Sal plodded along on the following Sunday night. The way was otherwise deserted, for she was the latest comer. As she neared the meeting-house the opening hymn sprang out as if to meet her, and she paused a moment to listen, for Alec's rich voice was leading, with the whole congregation swinging into the chorus:

When I wen' down en de valley ter pray,
Studyin' 'bout dat good ole way,
(Chorus: Who shell wear de starry crown?
Good Lord, show me de way.)
Ole Satan was deir fer ter hender me,
Layin' up unner de apple tree:
Who shell wear de starry crown?
Good Lord, show me de way.
He rustle de weeds as I come erlong,
So I lif' my soul en er holy song:
Who shell wear de starry crown?
Good Lord, show me de way.
He come right out by de side of de road,
An' 'e says, "Mister man, I 'll tote yo' load":
Who shell wear de starry crown?
Good Lord, show me de way.
Says I, "No use fer ter temp' we men,
De sinner got er better frien":
Who shell wear de starry crown?
Good Lord, show me de way.
Er shinin' ange-ul lit right down
An' 'e promus' me dat starry crown—
Oh, I 'm goin' ter wear dat starry crown:
Good Lord, show me de way; Good Lord,
Good Lord, show me de way!

As the refrain died out Sal entered the church and took a seat near the door. Many heads were turned—it takes so little to interest a church audience—and some few worshipers near at hand giggled, for the poor little romance in the girl's life was known, as all such things on a plantation invariably are. Aunt Tempy whispered to Aunt Chloe that Sal was after M'ria "like er houn' dog on er rabbit track"; and Aunt Chloe ducked her head down in her lap and shook all over with the violence of her appreciation. But fortunately at that moment Preacher Adkins stood up in the pulpit and said:

"Brer Manuel, will you lead us in de praar?"

There was a sudden commotion on all sides, and the congregation settled down upon its knees, and lifting his face an aged negro began:

"O Lord, look down upon us dis night, an' doan' turn yo' face erway f'om us, fur we come er-'seechin' de throne o' grace."

"Look, King!" responded the stentorian voice of Unc' Clay from his corner. "Amen!" exclaimed many voices fervently, while Unc' Peter under the pulpit uttered his low plaintive "Oom-oo-oo-oo-oo" like the tremulous call of a basso-profundo owl in the swamp.

"Lord, let yo' footsteps come over de moun-t'ins inter de valley, wher' yo' chillun es er-waitin' an' er-watchin' an' er-callin' fur yer, en de day-time an' en de night-time, ye'r en an' ye'r out!"

"Come down, King!" "Oom-oo-oo-oo-oo." "Amen! Amen! Amen!"

"Ef hit warn't fur you hit 'u'd be er sorry time down heah; hit 's bad ernough anyhow, but hit 'u'd be er heap worse. O Lord! de load 'u'd be hebbier, de sun 'u'd be hotter, de mule 'u'd git bofe legs ober de trace at de en' uv e'ry row, de plow 'u'd fine more stumps, an' our poor sufferin' souls 'u'd be jerked heah an' deir f'om de risin' up uv de sun ter de settin' down uv de same!"

"Yes, King!" "Oom-oo-oo-oo-oo." "Amen! Amen! Amen!"

"Lord, you know what es en our hearts, you see all de sin down en um; nobody c'n fool *you*, an' you es got yo' pow'ful eye on de sinner de very time he t'inks 'e es hid out bes'. Dey c'n fool ole Massa, dey c'n fool de ober-seer, an' dey wives an' dey husban's, but dey can' fool you. When you tarks dey shakes an' come sneakin' out. But, Lord, hit 's er poor,

sorry crowd atter all, an' hit ain't wuff yo' time ter projec' wid 'em. Let yo' mussy fall down an' cover 'em all—de las' one uv 'em; an' let 'em feel hit heah ter-night."

"Do it, King!" "Oom-oo-oo-oo-oo."
"Amen! Amen! Amen!"

"Lord, we don't know how long we got ter stay heah. Some got ter go soon, an' all got ter go atter erwhile. Las' ye'r dug more graves out yonner en de plum orchud dan de ye'r 'fo' lef' deir, an' dis one dug some too. Deir 'll be more deir 'fo' Christmus come. Last week Unc' Siah went; de week 'fo' Aunt Charlotte put two little baby-girls out deir—"

"Mercy, King!" "Oom-oo-oo-oo-oo."
"Amen! Amen! Amen!"

Charlotte's voice in a low chant broke into the prayer and continued to the end in counterpoint. Presently Unc' Manuel's glided into rhythm also, and the whole assembly rocked back and forth, keeping time with their bodies:¹

We all gotter go! An' I *reck'n* hit 'll be ole *Manuel* nex'; fur-somehow-my-legs-ain'-what-dey-onct-was; an'-w'en-I-git-down-hit's-mighty-bard-ter-git-up—mighty-bard-ter-git-up; fur-de-mis'ry-en-de-ole-man's-back; de-ole-man's-wearin'-out; but-es-trust-es-en-de-Lord; an'-e-ain'-nev'r-cail-but-de-Lord-come; mebbe-nex'-time-'e-won't-come-but-sen'-es-chariot.—

Send hit, King! Oom-oo-oo-oo-oo—

An'-es-snow-white-robe-too; sen'-es-snow-white-robe-too; an'-de-ole-man-go-'long-an'-fine-es-master. Oh,-hit 'll-be-er-great-day-an'-I-wish-hit-'u'd-come-erlong; an'-I-wish-hit-'u'd-come-erlong. All-'long-de-road-dey-dropped-down; mammy-an'-daddy-dropped-down; sissers-an'-brudders-dropped-down; frien's-an'-chillun-dropped-down; an'-lef'-me-heah-to-wark-erlone; all-by-myse'f-ter-wark-erlone—ter-wark-erlone. But-hit 'll-be-er-great-day-w'en-he-call-'em-all-up-ter-tell-ole-Manuel-howdy; yes-bit-will. Lord, doan'-let-none-be-missin'-w'en-de-horn-blows-fur-de-niggers-ter-git-up-fur-de-las'-time; none-missin'-f'om-de-lowes'-ter-de-highes'; let-em-all-git-deir—

Grant hit, King! Oom-oo-oo-oo-oo. Amen!
Amen! Amen!

(All:) Let-'em-git-deir!

"An'," concluded Unc' Manuel, resuming his usual voice, "thine be de kingdom, an' de glory, f'r ever an' dever, amen." To which all responded heartily.

¹ To imitate this negro, select one tone and keep it monotonously except on the italicized words, which are pitched two notes higher.

Preacher Adkins's black face rose up from behind the pulpit and shone out over his enormous cotton collar; but before he could give direction to the services a woman began singing, and the whole congregation joined her, their voices in sweet harmony, leaping out through the dreamy night. One grand soprano and one grand contralto lead all the rest, rising, falling, curving, and sinking to rise again in the moonlit silence. When the sun went down two mated swallows were cruising in the amber haze above the silent field, controlled by a perfect sympathy that linked them together under a single impulse. It was as though these had vanished into voices, and the ear followed their flight when the eye gave them up to shadows:

When I git up ter heaven
My work 'll all be done—
I'm goin' ter wark 'ith Mary
An' her darlin' Son.
I'm er-goin' up home,
I'm er-goin' up home,
I'm er-goin' up home,
Ter er-die no mo'.

I've foun' de load too heavy,
Too heavy ter tote erlone,
I'll lay hit down ter Mary
An' her darlin' Son.
I'm er-goin' up home, etc.

Sinner, de way ter glory
Es de road wher' Jesus run;
Hit 'll carry yer home ter Mary
An' her darlin' Son.
I'm er-goin' up home, etc.

O brudder, doan' git worry,
Yo' work es almos' done;
Meet me at de feet er Mary
An' her darlin' Son.
I'm er-goin' up home, etc.

"Sis' Charlut," said preacher Adkins, as the last tones died away, "will you lead us en de praar?" As the congregation sank to its knees again the slow, plaintive voice of the woman was heard:

"Our Father who art in heaven, I doan' ask yer ter lay as heavy er load on nobody's heart as yer laid on mine. Las' ye'r daddy an' mammy; dis ye'r my chillun—all gone,

all gone!"—the voice rose in a sudden wail that echoed out in the pines and thrilled the rude hearts about her,—“all gone; laid 'em en de cole groun' an' I'm lef' ter cry over dem—to cry! to cry!”

“Help her, King!” “Oom-oo-oo-oo-oo.” “Amen! Amen! Amen!”

“An' I have cried! But, O my God! I doan' cry 'ginst *you*—oh, no, not 'ginst *you*; fur I know hit's all right, hit's all right. But I have cried tell de piller was wet, tell de cott'n row was wet, tell de bread en my han's was wet, an' I'm er-cryin' now,”—her wail was almost a shriek,—“I'm er-cryin' yit—”

“Heah 'er, King!—” “Oom-oo-oo-oo-oo.” “Amen! Amen! Amen!”

There was a moment or two of sobbing and mingling of women's voices calling to one another, and then Charlotte's altered, and in a clear, suppliant chant was lifted again; and as she sang, the voices of the other women in a wordless chant ran over hers, making a wild, sweet melody in the church.

“O my dear Saviour, come down ter-night—an' let yo' sof' han'—fine us en de dark—let us see yo' face er-shinin'—let us see yo' blue eyes smilin'—let us heah yo' voice er-callin'—let us heah yo' sof' step comin'—en de lonely night. De sinner knows yo' step,—de sinner knows yo' smile,—de sinner knows yo' voice,—de sinner knows yo' touch;—deir ain' but one friend;—deir ain' but one Saviour; he's ernough fur me; he's ernough fur anybody;—he's ernough fur ev'body;—Lord, we are waitin', look at us! Look at us!—Look at us!”

“Look, King!” “Oom-oo-oo-oo-oo.” “Amen! Amen! Amen!”

“Er-kneelin' an' er-waitin'—er-watchin' an' er-prayin'; an' heah us!—an' heah us, dear Lord! an' bless us, fur we sho'ly need hit.”

Charlotte's voice had become hoarsened to a whisper and incoherent; finally a general “Amen” was uttered for her.

Up to this time in the prayer-meeting Sal had remained crouching with her face pressed in her hands. The eyes of several were still upon her, and there was considerable whispering among those nearest. Tempy said something to Chloe, but it did not produce a laugh this time. She went over silently to where Sal crouched, and kneeling there talked to her.



“MEN AND WOMEN STRUGGLED IN EVERY DIRECTION.”

She tried to pull the girl's hands from her face, but she held them tightly, and as the older woman whispered words of comfort Sal began to cry and moan. Some one had started another hymn: by that subtle influence which connects an audience the struggle in the mind of the young girl was known, and it gave direction to the services. It was Tempy who lifted her tremulous voice and led the way:

Wonner where Mary an' Marthy es gone,
Wonner where Mary an' Marthy es gone,
Wonner where Mary an' Marthy es gone,
Po' sinner's foun' er home at las',
Po' sinner's foun' er home en de new bright worl',
Po' sinner's foun' er home at las'.

Wonner where Mather an' Mark es gone,
Wonner where Mather an' Mark es gone,
Wonner where Mather an' Mark es gone,
Po' sinner's foun' er home at las', etc.

Wonner where Luke an' John es gone,
Wonner where Luke an' John es gone,
Wonner where Luke an' John es gone,
Po' sinner's foun' er home at las', etc.

O sister, es yer goin' ter follow too?
O sister, es yer goin' ter follow too?
O sister, es yer goin' ter follow too?
Po' sinner fin' er home at las', etc.

Several women were kneeling by the side of Sal, and all the congregation sank to their knees as Sal's mother in great excitement began to shout:

"Bless de name er de Lord! Bless de name er de Lord! My chile es comin' through."

"Bless de King!" Clay's voice rose like a clarion's.

"Oom-oo-oo-oo-oo!" There was a triumphant agony in the response that came from Peter.

"Amen!" was shouted by half a hundred lips.

"Er-comin' through! Hit's been er long time."

"Yes, sister!"

"Hit's been er long time! — but hit's come at las'; his han' done foun' 'er sinful heart, an' hit's er-leadin' de way."

"Bless the King!" "Oom-oo-oo-oo-oo." "Amen! Amen! Amen!"

"My chile es er-comin' through, she's er-comin' erlong de way!" The woman was swaying back and forth and clapping her hands. Her excitement was communicating itself to those around and her speech was growing thick and incomprehensible when suddenly she fell over, her voice died out, and her limbs stiffened. Two men lifted and carried her out gently, the congregation chanting and scrambling up again. As the little group passed Sal, she sprang to her feet and rushed to the front. She turned first to one and then to another, waving her hands and shouting in the cadence of a quickstep:

Glory!—glory!—glory, glory, glory!

Glory!—glory!—glory, glory, glory!

Glory!—glory!—glory, glory, glory!

Each took her hand, gravely shook it, and released it; and as she moved around, the feet of all beat time, as though the whole congregation was marching, while through it all ran the wild monotone, "Glory!—glory!—glory, glory, glory!" Occasionally a woman would shout a response and throw her arms around the girl's neck. Presently some began singing again, and all joined in the refrain until the church fairly thundered:

Sister Mary weep, Sister Marthy moan,
Who's on de Lord's side?
De Lord's side es de sho side,

Who's on de Lord's side?
O mo'ners, you on de Lord's side?
O mo'ners, you on de Lord's side?
De Lord's side es de sho side,
Who's on de Lord's side?

And through the weird melody in singular cadence rose the wild cry of the marching girl:

Glory!—glory!—glory, glory, glory!
O sister, lay yo' burden down,
Who's on de Lord's side?
De Lord's side es de sho side,
Who's on de Lord's side? etc.

Sal had made considerable progress on her circuit and was beginning to add a queer little shuffle to her march, popping her long, broad foot upon the resonant plank, when she came face to face with M'ria sitting in all the glory of the Ole Miss frock by the side of Alec. M'ria touched her escort in the side with her elbow and said aloud, grinning:

"Look at Bigfoot Sal!"

It was a fatal remark. Sal was fairly frenzied with excitement, and M'ria drew the whole current. Her rival sprang on her with the fury of a tigress, and in a few moments the Ole Miss frock was reduced to shreds. Sal lifted her light enemy into the air and brought her down to the floor with terrific force, M'ria giving expression to her pain and fear in frightful screams. As Sal tore and bit, the clockwork of her religious fervor ran on: "Glory!—glory!—glory, glory, glory!" she muttered. The congregation had been fired to a white heat by the conversion of the girl, and were just drifting into the ecstatic church dance when the sudden conflict began. M'ria's brother sprang over the benches intervening, and catching Sal by the hair began to cuff her vigorously. The next instant Alec, whose love for his dusky fiancée had only slumbered, jumped on his back like a catamount.

Plantation life is like village life; there are always two sides, and blood is thicker than water. In the excitement of the onset good intentions were mistaken for declarations of war, and when war developed it involved the whole community. Men and women struggled in every direction. Some took flying leaps out of the windows, and some, crawling over the heads of those who packed the doorway, dropped down safely outside, perhaps only to become involved at last, for many old debts



"SHE PASSED ON AMONG THE PINES."

are settled in such emeutes.

Gradually the crowd escaped to the exterior of the church and groups were formed on all sides. Fights were still in progress. Presently blows were suspended, and excited discussion took their place. Just at this moment, when a reaction was setting in, and friends

were pinning remnants of clothing over the almost nude forms of Tempy and Chloe, while the two loudly abused each other, out of the doorway came Sal. Her head was high in the air, her feet were keeping time to the monotone she was still somewhat exhaustedly shouting:

"Glory!—glory!—glory, glory, glory!"

The crowd gave way, and looking neither to the right nor the left, marching with measured tread, putting in every now and then her queer little shuffle, and slapping the roadway with her long foot, she passed on among the pines, her cotton dress appearing and disappearing at intervals until the distance and shadows swallowed her up. Silence for a moment fell upon the crowd, then a burst of laughter followed: the excitement had taken a more cheerful turn.

On went the girl, and faintly sounded the marching cadence:

"Glory! — glory! — glory, glory, glory!"

Then it died away in the distance, and the crowd found itself interested in two wrecks that crept out of the church and appealed to their sympathies. One was M'ria; the other, Peter.

Slowly, still arguing, the gathering dissolved. But as the scattering groups faded away through the patches of moonlight and shadow, and the night hushed discord, from away up the road where it winds around the house and Missy's darkened bedroom at the corner, there came floating back the words of Sal's triumphant hymn:

"Glory! — glory! — glory, glory, glory!"

H. S. Edwards.

HARPER'S NEW MONTHLY MAGAZINE — DECEMBER, 1864

DEBATES ON ARMING SLAVES

Governor Brown, of Georgia, between whom and President Davis there is a bitter feud of long standing, on the 24th of February sent a message to the Georgia Legislature, in which he makes a bitter attack upon the policy and measures of the Confederate Government at Richmond. We quote a considerable portion of the telegraphic abstract of this message, as published in the Richmond papers of February 28:

He opposes the arming of the slaves, believing them to be more valuable as agricultural laborers than they could be as soldiers. They do not wish to go into the army, and the principal restraint now upon them is the fear that if they leave, the enemy will make them fight and compel them to take up arms, and they will desert by thousands. We can not expect them to perform deeds of heroism when fighting to continue the enslavement of their wives and children, and it is not reasonable to demand it of them. Whenever we establish the fact that they are a military people we destroy our theory that they are unfit to be free. When we arm the slaves we abandon slavery.

The question of arming the slaves has been warmly discussed in the Confederate Congress, where, as well as in the Executive department, there is a great difference of opinion on the subject. General Lee, in a public letter, strongly advocates the measure. He writes, under date of Feb. 18: "I think the employment of negroes as soldiers not only expedient but necessary. The enemy will certainly use them against us if he can get possession of them, and as his present numerical superiority will enable him to penetrate many parts of the country, I can not see the wisdom or policy of holding them to await his arrival. . . . I do not think that our white population can supply the necessities of a long war without overtaxing its capacity and imposing great sufferings upon our people. . . . In my opinion the negroes, under proper circumstances, will make good soldiers. . . . I think that those who are employ-

ed should be freed. It would, in my opinion, be neither just nor wise to require them to serve as slaves. The best course would be to call for those who are willing to come with the consent of their owners. . . . I have no doubt that if Congress would authorize their reception into service, and authorize the President to call upon individuals or States for such as they are willing to contribute, with the condition of emancipation to all enrolled, a sufficient number would be forthcoming to enable us to try the experiment. If it prove successful most of the objections to the measure would disappear, and if individuals still remained unwilling to send their negroes to the army, the force of public opinion in the States would soon bring about such legislation as would remove all obstacles."—Bills to this purpose have been introduced into both Houses of Congress. That in the House of Representatives passed on the 20th of February, by a vote of 40 to 37. It empowered the President to ask and accept the services of as many negroes as he deemed expedient, to be employed during the war on any military service which he should direct; that these troops should receive the same pay and rations as white troops; that if a sufficient number of colored recruits was not obtained, the President might call upon each State for its proportion of 300,000 men, to be raised irrespective of color, from persons not subject to military duty under existing laws; and that nothing in this act should work any change in the relation of master and slave, except by the consent of the owners, and of the States in which they reside. But, in the mean while, the bill originating in the Senate was lost, on the 21st of February, by a vote of 11 to 10, both of the Virginia Senators voting against it. Thereupon both branches of the Virginia Legislature passed resolutions directing their Senators to vote for the arming of slaves. The

Southern theory being that Senators in Congress are bound to obey the instructions of their State Legislatures, it is probable that the Virginia Senators will reverse their votes, which would make a majority of one in favor of the measure. The Senate of Virginia also, on the 25th of February, passed a bill, by a vote of 27 to 3, which was sent to the House of Delegates, authorizing the Governor to call for volunteers for one year from the free negroes and slaves, to "aid in the defense of the capital and such other points as are or may be threatened by the public enemy;" these volunteers to be commanded by white officers. The bill suspends, in the case of these volunteers, the operation of the laws prohibiting the carrying of arms by slaves and free negroes.

APRIL, 1865

By various laws now existing in the Confederacy all free negroes between the ages of 18 and 45 are made liable to perform military duty upon fortifications and in Government works. The Secretary of War is also empowered to employ in a similar manner 20,000 slaves, the owners to be paid in case

of their escape or death. If they can not be hired they may be impressed. The Southern papers urge that these laws shall be carried into immediate execution. The *Richmond Enquirer* of October 6 also urges that free negroes and slaves shall be employed as soldiers. It recommends that the Confederate Congress shall purchase 250,000 negroes, present them with their freedom, grant them the privilege of remaining in the States, and arm, equip, drill, and fight them. It says that these freedmen could be depended upon not only for ordinary services, but for the hardest fighting.—A letter from Henry W. Allen, Governor of Louisiana, to Mr. Seddon, the Confederate Secretary of War, dated September 26, has been captured, in which he urges the employment of negroes as soldiers. He says: "The time has come for us to put into the army every able-bodied negro man as a soldier. This should be done immediately.... We have learned from dear-bought experience that negroes can be taught to fight, and that all who leave us are made to fight against us. I would free all able to bear arms, and put them into the field at once. They will make much better soldiers with us than against us, and swell the now depleted ranks of our armies."

THE CENTURY MAGAZINE — MARCH, 1890

BLOODHOUNDS AND SLAVES

AN interesting article on the English bloodhound, by Mr. Edwin Brough, in the June, 1889, number of *THE CENTURY MAGAZINE*, reminded me of the long-standing slander that the Southern master formerly used the bloodhound to run down his runaway slaves. Mr. Brough says that the English bloodhound "is quite different . . . from the Cuban bloodhound of slave-hunting notoriety." We look at the article "Bloodhound," in "Chambers's Encyclopædia" (J. B. Lippincott & Co., editions of 1884 and 1887). I find the following statements: "The Cuban bloodhound, which is much employed in the pursuit of felons and fugitive slaves in Cuba, differs considerably from the true bloodhound of Britain and continent of Europe, being more fierce and having more resemblance to the bull-dog. . . . It is this kind of bloodhound which was formerly employed in the United States for the recapture of fugitive slaves." It is not surprising that Englishmen should believe all this, as it is what we told them of ourselves. Laying aside the brutality, one would hardly think that an ordinarily sensible man would purposely select so ferocious a brute as the Cuban bloodhound is reputed to be to tear to pieces or maim a valuable chattel worth \$1000 or \$1200, especially as this animal, "resembling the bull-dog," is very deficient in nose. This simple statement ought to show the absurdity of the slander. As to this Cuban bloodhound—so terrible to the morbid imagination—and

its use in the Southern States, I have lived for many years in Virginia, Georgia, and Alabama, and I can count on the fingers of one hand every one I ever saw. They were said to be fierce, and were used as guard dogs when used at all.

The dog used in the Southern States for tracking criminals and fugitives was the ordinary little foxhound of the country, familiar to everybody. His nose is all but infallible, but he is very timid about attacking man. Consequently, while it was next to impossible to escape him, the master of the colored fugitive knew that his property was in no sort of danger.

To illustrate this: when I was a boy living in Georgia I was fond of talking with an intelligent colored man who belonged to a neighbor. On one occasion he "took to the woods." Trained foxhounds were put on his trail with the usual result. I asked him after he was brought home if he had not been frightened when the dogs came up with him. He laughed at the question and said: "I knew when they found me there was no use running, as they would follow; but they won't trouble anybody. I just took up a little stick, and they stood off twenty or thirty yards barking." The first time I ever knew of dogs being used to track any one illustrates their disregard for color or condition. A wealthy and respected man who lived near a Southern city took a fancy to increase his wealth by setting fire to his barn, which was insured. About

daybreak the hounds were produced to find the criminal. To the surprise of everybody, the trail was carried to his front door by the dogs. No one prosecuted him for burning his own barn, but the canine evidence destroyed his standing in the community and prevented his getting the coveted security.

I suppose it will hardly be believed, but, as a fact, dogs were rarely used in the South for tracking human

beings. I never knew of a case where they were used in Virginia, and I lived several years in the black belt of that State. I saw but one pack in Georgia, where I lived many years, and I never heard of a pack in Alabama, where I spent a good deal of my youth in a planting community where the colored people predominated largely in numbers.

William N. Nelson.

ALEX HALEY PAYS FOR PLAGIARISM

Alex Haley, the author of the celebrated work, *Roots*, recently agreed to pay Harold Courlander, the author of a novel called *The African*, and his publisher, Crown, more than a half-million dollars. This huge payment was made in settlement of a suit charging that Haley, in writing *Roots*, had substantially copied from *The African*.

The press reports of the settlement indicated that Courlander had charged that over 80 passages in *Roots* had been copied from his book. However, Courlander's complaint went much further than this. He charged that the material Haley copied "constituted the framework, life and substance of *Roots*." The legal brief said that "Mr. Haley copied language, thoughts, attitudes, incidents, situations, plot and character." It asserted: "Without *The African*, *Roots* would have been a very different and less successful novel, and indeed it is doubtful that Mr. Haley could have written *Roots* without *The African*."

These charges were backed by detailed documentation submitted to the court, including evaluations prepared by two professors of English at Columbia University. Robert W. Hanning, professor of English and Comparative Literature prepared a 41-page analysis of the similarities found in the two books. He drew these conclusions:

"1. The similarities between the two books are not accidental; they lead to the conclusion that Haley knew and copied from *The African* in writing *Roots*; and that many of these copyings in turn underlie incidents and characters in the *Roots* teleplay.

"2. The similarities between *The Af-*

rican and *Roots* are substantial, and the material in *Roots* that shows these similarities are both qualitatively and quantitatively important to the language, plot, content, form and overall impact of Haley's novel. Without the materials Haley copied from *The African*, *Roots* would have been a far different and, in my opinion, a less effective novel. I believe the materials Haley copied from *The African* were crucial to the success that *Roots* has achieved."

Prof. Hanning found that the section of *Roots* that describes the life of Kunta Kinte, the young African who was captured by slavers and transported to America, follows closely the overall structure of Courlander's account of the life and attitudes of a remarkably similar young African named Hwesuhunu. Haley's hero, Kunta Kinte, grew to manhood in the Gambia; Hwesuhunu went through the same process in Dahomey. Each, before his capture by slavers, had a strange dream, foreboding trouble.

They had remarkably similar experiences and companions on the slave ship that carried them to America. For example, they were both assailed by lice. Courlander's lice "worked their way into the hair and the body crevices. They crawled on the face and drank at the corners of their eyes." Haley's "were worst wherever the body crevices held any hair. . . . But the lice preferred to bite him on the face, and they would suck at the liquids in the corners of Kunta's eyes. . . ."



ALEX HALEY

Each of the heroes, in the hold of the slave ship, found that his companion on the right came from a neighboring tribe and spoke enough of his language that they could converse. Each had as his neighbor on the left an old man who would not say anything and who died during the voyage. Each saw a slave leap overboard and dangle above the water, held by the chain that bound him to nine other slaves. On both voyages one of the slaves died of a gangrenous leg and was thrown overboard. The ships went through remarkably similar storms, and after reaching America the heroes had some remarkably similar experiences.

The outstanding characteristic of both heroes was their unwillingness to forget their African heritage. They both refused to follow the other slaves in their apparent acceptance of their degraded status as chattels, lacking any sense of their African identity and heritage. This concept won praise for Courlander's novel in 1968. Ten years later it helped Alex Haley win a Pulitzer Prize and a fortune, part of which he will now share with Harold Courlander.

Handy Farm Devices and How to Make Them

By Rolfe Cobleigh
Associate Editor American Agriculturist

ILLUSTRATED

NEW YORK
ORANGE JUDD COMPANY
1910

By Way of Introduction

SUCCESS comes to the man who so works that his efforts will bring the most and the best results—not to the man who simply works hard. It is the know-how, things-to-do-with and economy that count. Labor-saving machinery has revolutionized many a trade and industry. It has made farming an industry and a science of possibilities undreamed of and unattainable a hundred years ago. But it is not enough for the modern farm to be equipped with the best tools and machinery that shops and factories turn out, to know how to use them and keep them in repair.

There are many handy devices, not made in any factory and not sold in any store, that every intelligent man can make himself, which save money and labor and time. Inventive men are constantly contriving simple but valuable things to meet the needs of their own practical experience. We are all the time hunting after and gathering these ideas. Now we are putting a lot of the best ones into this book. We are trying, by words and pictures, to explain clearly just how to make each device. Everything described is tried and practical. Some are old, many are new, all are good for the purpose intended. They represent the practical, successful experience of farmers and other wide-awake workers all over the United States.

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This book is broader than its title. The overflow of good measure includes a valuable chapter on the steel square and its uses. Nowhere else has this subject been handled in a way so easily understood, with confusing mathematics cut out. We especially commend this chapter to our readers. We also present some good house and barn plans, that will be appreciated by those who contemplate building.

In addition to the direct benefit to be derived from doing what the book tells how to do, we have

in mind the larger purpose of education toward putting more thought into our work and doing what we have to do the easiest, the cheapest and the quickest way. Out of it all, we trust our readers will make progress toward greater prosperity, greater happiness and greater usefulness.

7



WORK · SHOP · AND · TOOLS ·

THE FARMER'S WORKSHOP



THERE is no doubt that of all the handy farm devices good tools head the list. So, in this book, we are going to start with carpenter tools and the place to keep and use them. Every farmer ought to have a workshop in which he can do odd jobs and make things when the weather prevents out-of-door work, or at times when there is little to do on the farm. Economy and thrift demand that a farmer should have and keep in good condition a few essential carpenter tools. First of all he should have a long, strong, smooth-top bench and, either on racks above the bench or in a tool chest, he should keep in order, and where he can easily find them when wanted, his stock of carpenter tools. Some of the tools that will be found useful are the following:

A rip saw, a crosscut saw, a back saw, and a compass saw; a jack plane, a fore plane, and a smoothing plane; a shave or drawing knife; two or three chisels of different sizes for woodworking and a cold chisel for metal; a gouge or two; a good hatchet; two or three hammers, including a tack hammer and a bell-faced claw hammer; a brace or bit stock with a set of half a dozen or more bits of different sizes; one or more gimlets; a mallet; a nail set, a large screw driver and a small one; a gauge; a spirit level; a miter box; a good carpenter's square—No. 100 is a good standard size;

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compasses or dividers; cut nippers, a pair of small pincers and a pair of large ones; a rasp; a large, flat file; at least one medium-sized three-cornered file and a half-round file.

It is poor economy to buy cheap tools. Of course extravagance is to be avoided, but be sure that you get first-class material in every tool you buy. It is a good plan to get a good practical carpenter to assist you in selecting your tools. Keep on hand in the shop a variety of nails, brads and tacks, screws, rivets, bolts, washers and nuts, and such small

articles of builders' hardware that are likely to be needed occasionally, including hinges, hasps and staples and some sand-paper. Have a good plumb line, chalk and pencils. Keep in a handy place a jar of a good liquid glue, and some cement. See to it that the shop contains a good stock of well-seasoned lumber, both hard wood and soft.

Attached to the bench should be a bench screw or vise. This need not be an expensive one, but should be of good size and strong. There should also be a pair of carpenter's saw benches, a shaving horse, a small anvil and a grindstone. Every farmer has a grindstone somewhere about the buildings, but it is a great convenience to have a good one in the workshop.

A corner of the shop should be devoted to painting supplies, including several colors of good standard ready-mixed paints and stains, raw linseed oil, boiled linseed oil, turpentine, varnish, putty, points for setting glass, several brushes of different sizes, a good putty knife and panes of glass of different sizes ready for emergency.

A farmer ought to be able to do occasional little jobs of soldering. He needs soldering iron, a bar of solder, resin, a little bottle of soldering fluid,

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which can be purchased already prepared, also a small sheet-iron furnace in which to heat the soldering iron.

It would cost quite a tidy sum to buy all these things at once, but they can be gradually accumulated as one is able to purchase them, and then the outfit should be kept complete. Whenever anything in the shop is broken, worn out, or disappears it should be replaced.

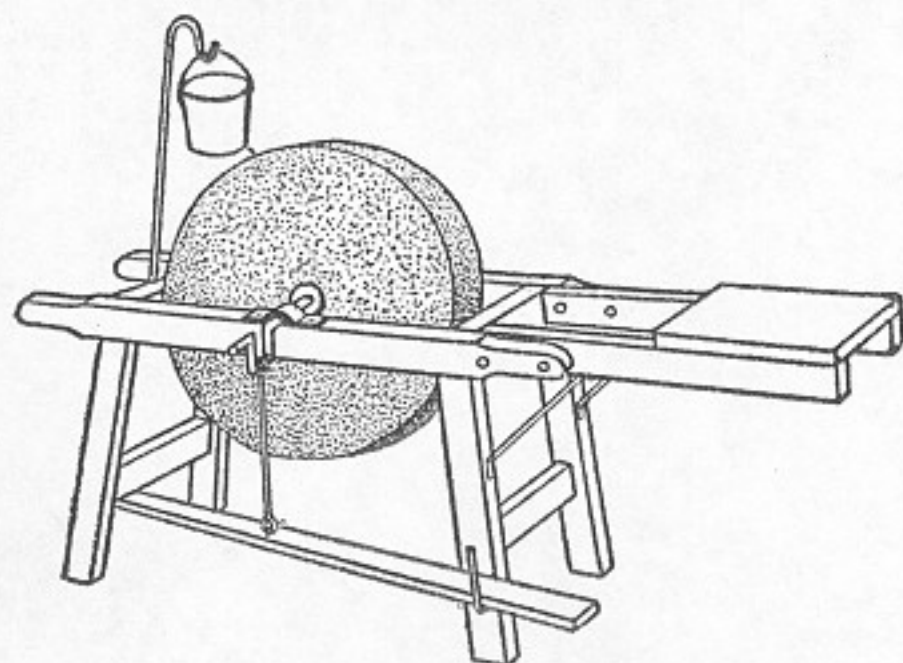
Whenever farm implements or anything about the barn or house are broken or out of order, they should be properly fixed. Often a few minutes spent at the right time will make a thing almost as good as new, while, if neglected, it may soon get beyond repair and have to be thrown away. A thrifty farmer always keeps his farm implements well housed and in repair. It is not what we earn, but what we save, that makes us rich. It is quite as important to stop the leaks as it is to figure on big profits directly.

RUNNING THE GRINDSTONE

If the face of the grindstone is hard and glazed pour a little sand on the stone every few minutes until the glaze is worn off and the stone will cut like a new one. This condition is caused by exposing the stone to the weather. It is best to keep the stone in a shed under cover, but if this is not possible, set it under a tree and put a box over it

when not in use. It is surprising how easy a little oil on the bearings will make the stone run. A few drops of kerosene will cut the gum if it runs hard and then some oil or axle grease will make it go easy.

It is hard to stand on one foot and work the treadle with the other. The job can be made easy by bolting two boards to the grindstone frame, and extending it 2 feet, on which place a seat as shown



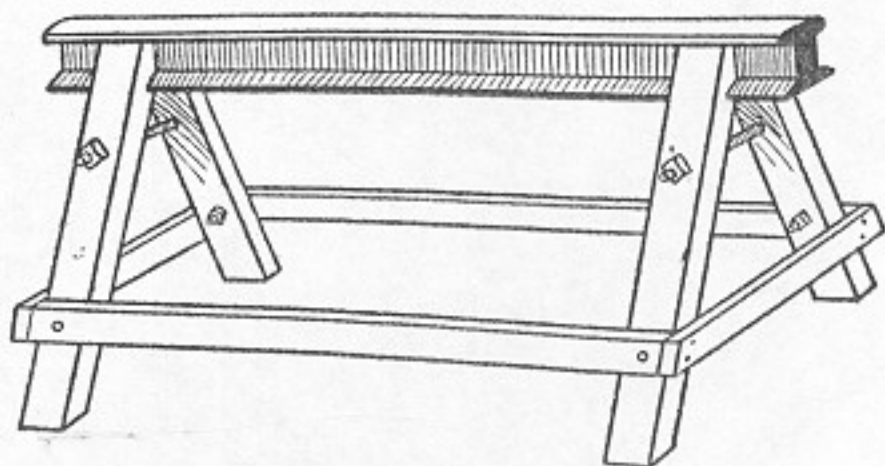
HANDY GRINDSTONE RIG

in the cut. An uneven stone needs to be cut down and toned up. This can be done by grinding against the end of a piece of pipe, having the stone dry.

A HOMEMADE ANVIL

A homemade anvil can be constructed from a 4-foot piece of railroad rail mounted on a trestle, as shown in the sketch. This affair will stand a lot

of heavy pounding, and comes in handy in many ways. The rail is just about the right shape to make an anvil.

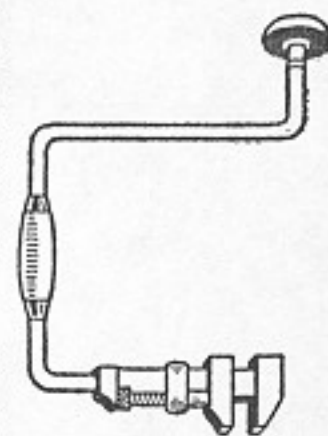


RAIL ANVIL

MAKING A NEW TOOL

A very handy wrench for many kinds of work,

such as making gates and contrivances, where small bolts are used, is shown in the cut. From a small monkey wrench remove the wooden handle, and weld the metal part to an old bit-stock, as shown in the cut. This permits of very rapid work in screwing up small bolts. Where there are so many things to do as there are on a farm, it pays to do things in the easiest and quickest way. This is one of the real time-savers.

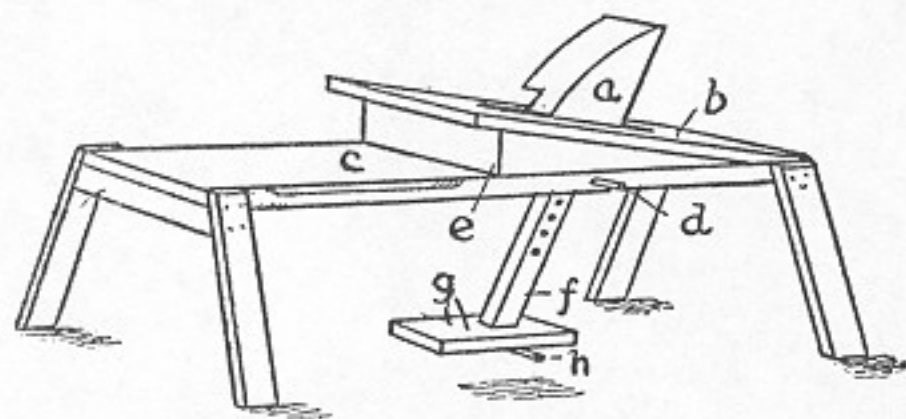


BIT-STOCK WRENCH

HOW TO MAKE A SHAVING HORSE

One of the most useful devices on a farm is a shaving horse. Make a bench 18 feet high of a good 2-inch plank, *c*, level off the edges so that it will make a comfortable seat. Upon this place a slanting platform, *b*, through which is cut a hole in which the clamp, *a*, works.

The clamp must be made of heavy hard wood that is tough and will not split. The shank, *f*, must



SHAVING HORSE

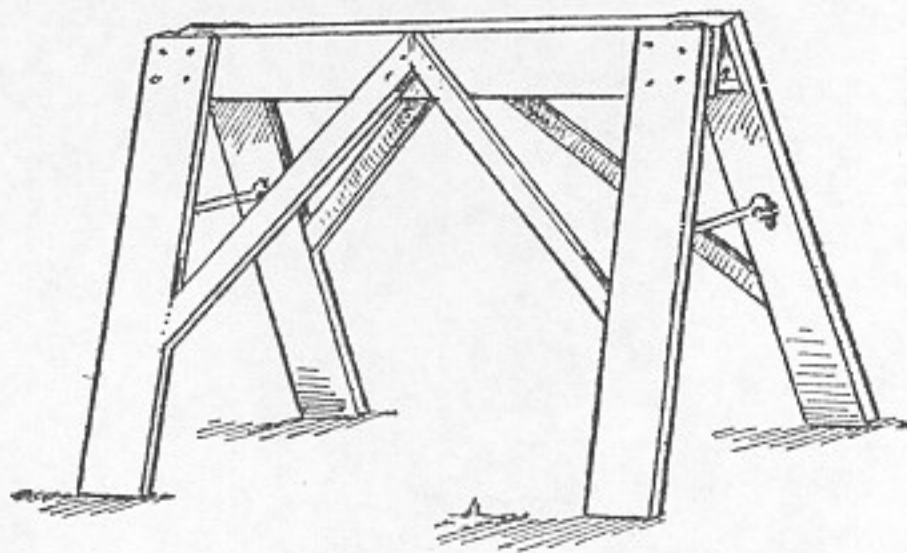
be an extension of the clamp, *a*. Several holes in the plank will allow the clamp to be raised so as to take in larger pieces of wood. The treadle, *g*, is kept in place by a peg at *h*. To operate this horse the workman places his foot upon the treadle, inserts the wood to be clamped under the edge of *a*, and pushes backward upon the treadle. This clamps the wood and the drawing knife can be used readily and much more rapidly than with a vise.

A CONVENIENT FARM HORSE

On the farm there is continual use for such a horse as is shown in the drawing. Not only when

doing little jobs of carpentering, but also in many other operations, such a support is found necessary. This little horse is an improvement over the ordinary stiff affair, in that it shuts together when

not in use, and so can be packed out of the way.



HORSE READY FOR USE

It is made of boards cut in strips, the two horizontal boards at the top being hinged together, as shown herewith. While in use the legs are kept apart by long hooks, as may be plainly seen in the picture.

When tillage begins, other arts follow. The farmers, therefore, are the founders of human civilization.—Daniel Webster.

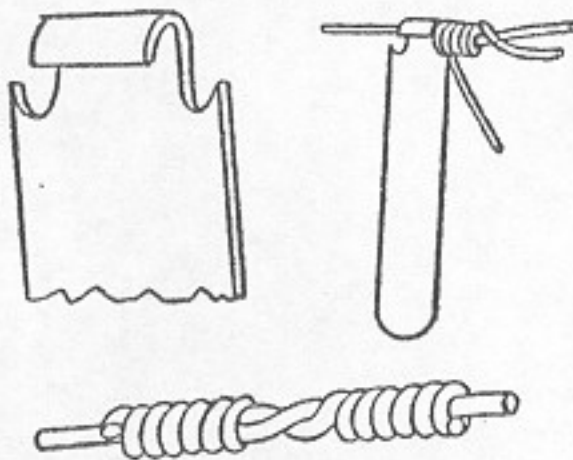
A WIRE SPLICER

The neatest and strongest splice can be made with this little instrument. It is a strip of iron 1 inch wide and $\frac{1}{8}$ inch thick. One end is cut narrow and is bent into a hook large enough to fit

neatly the largest wire to be spliced. At the sides of this two notches are filed, as shown at the left. At the right the splicer is seen in position on the wire. The splicer

should be turned backward, as it appears in the right-hand drawing, to make the splice. A pair of large pincers or a vise should be used to hold the two wires between the coils while turning the splicer. The

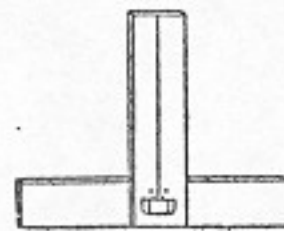
splice as finished appears above. The length of the handle may vary. If the splicer is to be used for net wire, of course the handle cannot be longer than the width of the mesh. Otherwise, 6 or 7 inches is about right for No. 8 wire. If it is to be used only for small wire, the length of the handle should be reduced for the sake of convenience.



WIRE SPLICING

SERVICEABLE HOMEMADE LEVEL

A serviceable level is shown in the illustration. Take two 1-inch boards of rather hard wood, well-seasoned, 2 to 3 feet long, bolt or screw them together at right angles. This union must be so strong as never to be moved by ordinary pressure. At the top of the perpendicular piece cut a slit and insert a piece of strong thread. To the bottom of the thread tie a thin circular



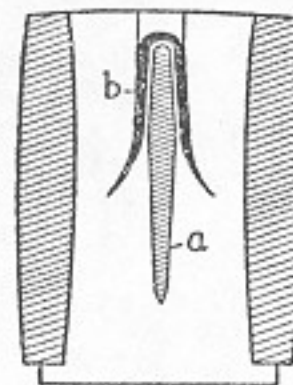
LEVEL

weight. Lay the device across two trestles of nearly the same level. Just above the weight mark the place where the string hangs. Reverse the position of the instrument by turning it end for end, and again mark the position of the string. Half way between the two marks place a third. When the string hangs over this mark the lower board will be level. A shield of tin may be placed over the weight. A nail on each side of the string, just above the weight, will keep it from swinging far out of place. It must be allowed to swing freely.

A simple level may be improvised by filling a small flat bottle with water, so that only a bubble of air remains, and attaching it lengthwise and near the middle of a straight stick or narrow board.

TO MAKE A HANDLE STAY ON

To secure the handle of a hammer or ax is often quite a bothersome problem. A special wedge made with a piece of wood as at *a*, in the sketch, held in place by a fence staple, *b*, has been devised to meet the need for a wedge that really holds. The prongs of the staple should be bent slightly outward before it is driven in, so that they will spread in the handle. There is little danger of handles coming loose when they are attached in this manner, and it is little more difficult to set a handle as indicated than in the old-fashioned way.



HOLDS WEDGE

A TOOL BOX REQUISITE

Among the handiest things to have in the tool box are some small bolts about 2 inches long with thumb nuts. A dozen or so of these will prove their value many times over in the course of a year.

In making tables for fairs or suppers or in any sort of knock-down arrangement, or temporary convenience where strength is essential, nothing surpasses a bolt of this description. With a brace and a bit the right size, one may be entirely independent of nails and screws.

A farmer friend of ours was once called upon to make a fence about a child's crib without any marring nails. A slot in the fence post with a thumb bolt just above the crib line gave an alligator jaw result which was very satisfactory. On another occasion a knock-down stage was carried from the storeroom in pieces and put together by two men in 20 minutes. An actual computation of its strength showed that a locomotive might safely run over it.

The man referred to above has 100 feet of tables for hall purposes, depending entirely upon the 2-inch bolt and thumb nut for their fastenings and braces. There is never any trouble about knocking out nails. To one having a brace and bit these handy things will suggest of themselves many satisfactory uses. A supply of iron washers should be kept in hand, and in time a collection of various sizes of wooden washers will accumulate.

SOLDERING

Soldering may be done by anyone having a very simple outfit. All that is required is a copper sol-
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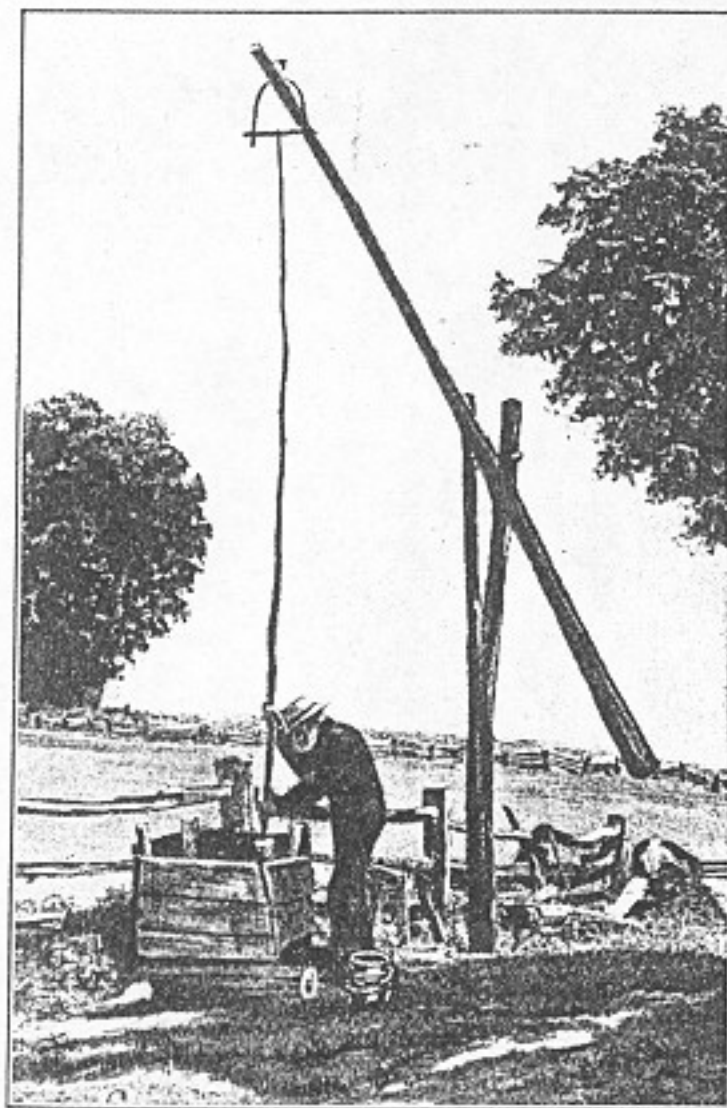
dering iron, some solder, a vial of muriatic acid and some resin. A fairly successful job of soldering a tin dish may be done by scraping the surface bright where the hole is, sprinkling on a little finely powdered resin, laying on a bit of solder and holding the dish over a flame, which may be from an alcohol lamp, until the solder melts. It will cover the hole and stick. If the dish is rusty or badly tarnished use muriatic acid in place of resin. Resin works best when tin is bright, but usually solder sticks most successfully when the acid is used.

For soldering large breaks or doing important jobs of soldering the iron must be used. In order to work well the iron has to be kept coated with solder. When it gets blackened it should be filed until bright and then rubbed upon a smooth board while hot in a mixture of melted solder and resin. When the hot iron is taken from the fire wipe it on a damp cloth before trying to use it to lift the melted solder. A soldering iron is best heated in charcoal or the coals of a wood fire. The copper should never get red hot, as that causes the coating of the point to be burned off. The metal to be

soldered must always be heated before the solder will unite it.

Solder may be obtained in bars at any tin shop. It can be made by melting together 2 parts of lead and 1 of bar tin. This is the usual proportion for most purposes. Soft solder that will melt quickly and can be easily used for mending tinware can be made of pure lead and tin in equal parts. A hard solder is made by melting together 2 parts of copper to 1 of tin. Brazing solder is made by melting together brass and one-sixth its weight of zinc. When cool it should be granulated by pounding

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with a hammer. For soldering steel and iron to brass the following combination of metal is melted together, 3 parts tin, 39½ copper, and 7½ zinc. Before it is applied, all the metals to be jointed together must be heated to the same temperature as the soldering alloy. Gold solder is made of 24 parts gold, 2 parts silver and 1 part copper. A hard silver solder is made of 4 parts silver to 1 of copper. A soft silver solder is made of 2 parts silver to 1 of brass.



A TIME-HONORED HANDY DEVICE



Use of the Steel Square

BY J. HAMILTON ELLIOT



A steel square, often called a carpenter's square, can be found in almost any kit of mechanic's tools and a little knowledge of this instrument will aid the user to perform many problems easily and quickly that otherwise might prove difficult. Squares of different kinds and materials have been used by mechanics in all ages. The first were made of wood and were used in the construction of the earliest buildings of which we have historic record. The squares of today are made of steel, finely polished and stamped with many

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figures, tables and rules, according to the taste of the manufacturer and the special mechanic for whom they are designed.

We will not attempt to deal with the several special kinds or makes, taking up only a few of the possibilities of the standard 2-foot square. This is 2 feet long on the blade, which is two inches wide, and it is 16 or 18 inches on the tongue or angular leg. The latter is $1\frac{1}{2}$ inches wide. Beginning at the heel or corner of the square, inches and fractions of inches are marked. It is necessary that the marking be in this way, in order to form the different combinations desired in connection with the different problems which have to be solved. A few of these problems are explained in the following pages.

LUMBER RULE

On the side of the blade of the square that is divided into inches and eighths is placed the lumber rule or scale. This is used for computing the number of feet in board measure contained in a given board or piece of lumber. We show a picture of a section cut from the center of the lumber rule. The space running lengthwise of the blade between the parallel lines contains the number of feet board measure for a given width of board. The first space is for boards 8 inches wide, the second for those 9 inches wide, the third for those 10 inches wide and so on. To determine the space which should be used for any given width, look under the 12-inch mark on the outside edge of the blade. These numbers give the width of the board, also the number of feet board measure. If a board is 10 inches wide and 12 feet long, it contains 10 feet board measure.

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Now let it be required to find the number of feet board measure in a board 13 inches wide and 11 feet long. Find the space for boards 13 inches wide under the 12-inch mark on the square, follow this space to the left and under the 11-inch mark on the square will be found the answer desired: 11-11. This is read 11 feet and $\frac{11}{12}$, and is the number of feet board measure contained in a board

11	12	13	14
7-4	8-	8-8	9-4
8-3	9-	9-9	10-6
9-2	10-	10-10	11-8
10-1	11-	11-11	12-10
11-11	12-	12-12	13-2
12-10	13-	13-13	14-4
13-9	14-	14-14	15-6

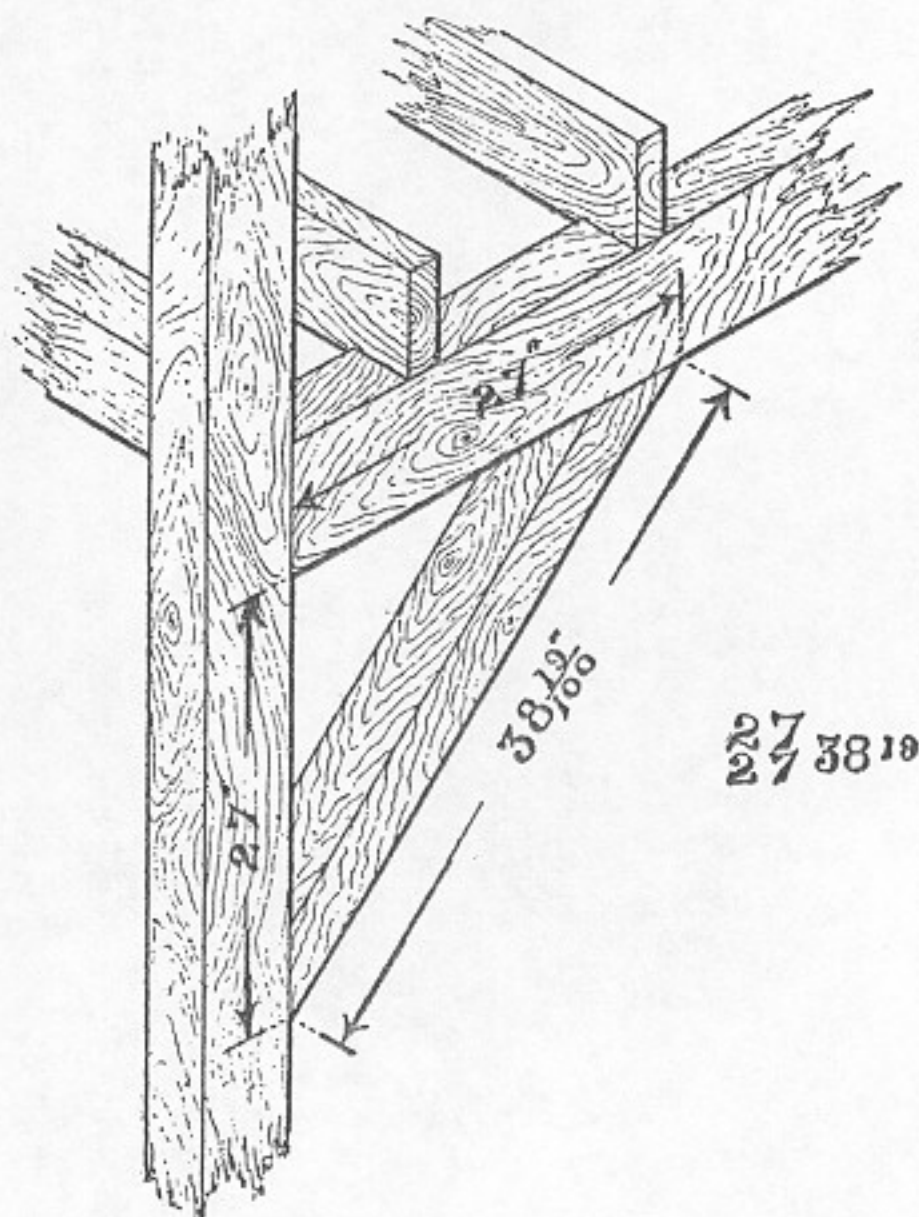
LUMBER RULE

13 inches wide and 11 feet long. With a little practice, anyone can measure lumber or timber and check up his bills for this kind of material.

Do not confound foot board measure with square feet. Square feet are in surface measure, with no reference to thickness, while a foot board measure is the equivalent of a foot square and 1 inch in thickness. The square feet of a 3-inch plank would contain 3 feet board measure.

After becoming familiar with the use of the lumber rule, as described above, you will discover that the space may be taken to contain the amounts for a given width and the different lengths in feet as represented in the different columns, or the space may be taken as containing the amounts for a

given length and the different widths arranged in columns; therefore, find either length in feet or width in inches under the 12-inch mark and follow this space until under the inch mark representing the other measurement. In this space will be found the feet board measure.



BRACE RULE

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THE BRACE RULE

The brace rule is on the tongue of the square, and has a series of figures representing the rise or vertical height, the run or horizontal reach and the true length of a brace. For example, they are written $27/27$ $38^{19}/100$ and $45/45$ $63^{64}/100$. These would be read 27 inches run, 27 inches rise and a length of 38 and $19/100$ inches, and 45 inches run, 45 inches rise and a length of 63 and $64/100$ inches.

A glance at the illustration on page 22 will give a good idea of the application of the brace rule as it appears on almost any modern make of square.

THE OCTAGON SCALE

There is an octagon scale on one side of the tongue of the square, but we will not attempt to explain its use, as there are easier and simpler methods of obtaining the same result.

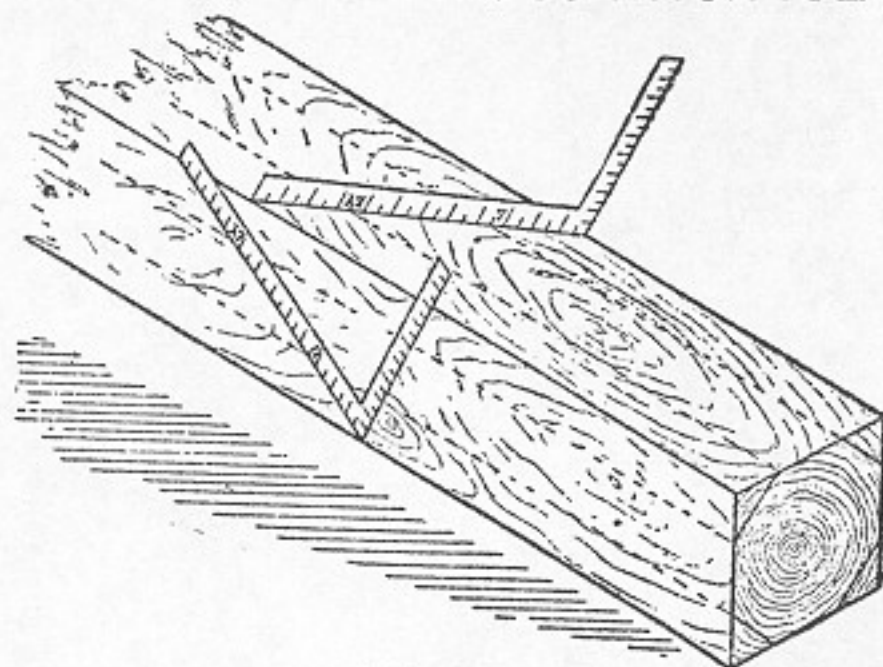


FIGURE I

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One method is shown in Figure I. To obtain the lines on a square stick where the corners should come when converted into an octagon or eight-sided stick: Lay the square on the one side of the square stick at such an angle that the end of the square will come exactly at the edges or corners of the stick, make a dot on the 7-inch mark and at the 17-inch mark. Through these dots gauge or mark a line parallel with the edge of the stick. Continue this operation on all of the four sides. This gives the lines for the corners of an octagon. In making a flag-pole or spar for a boat or to round any large stick this is the operation used by all mechanics doing the work by hand.

THE MITER BOX

Of all homemade devices, one of the most frequently used in the shop is the miter box.

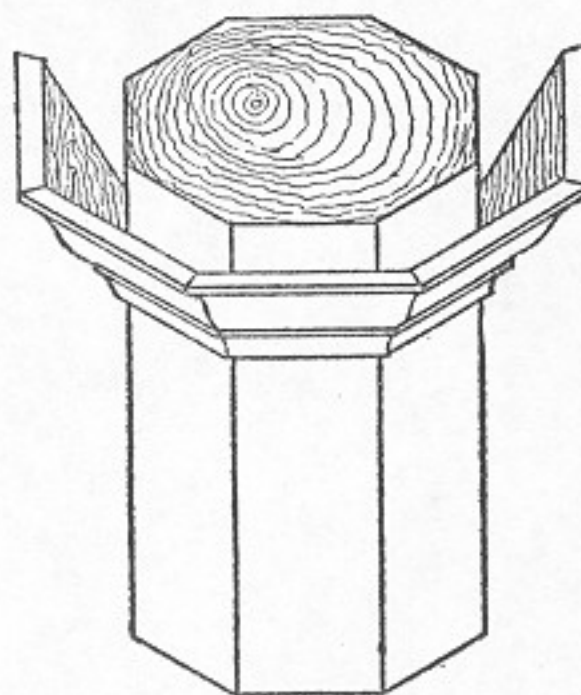
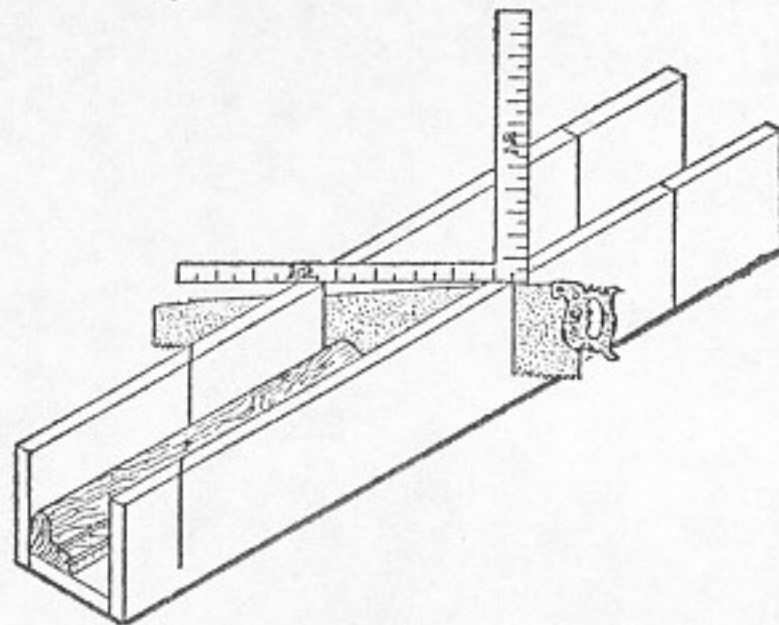
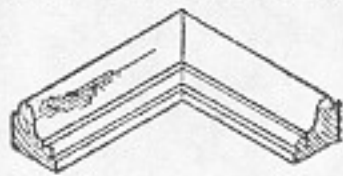


FIGURE 5A

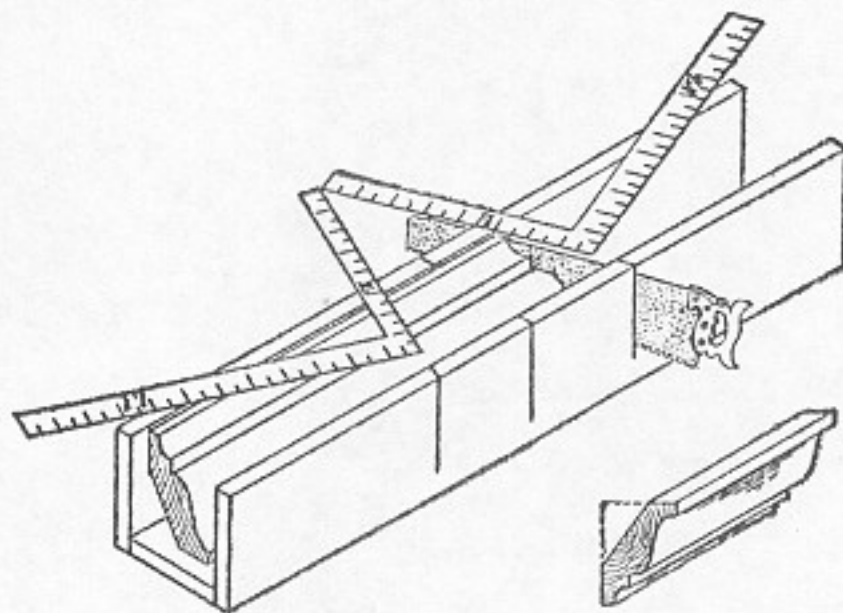
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After the box is put together it is a simple problem, with the use of a steel square, to make the cuts necessary to intersect two pieces of wood, as shown in Figure 2. First, the box must be straight and true and the sides form a perfect right angle or square with the bottom. Lay the steel square on the top

of the box so that the 12-inch mark on the blade and the 12-inch mark on the tongue will both come



FIGURES 2 AND 3

FIGURES 5 AND 4
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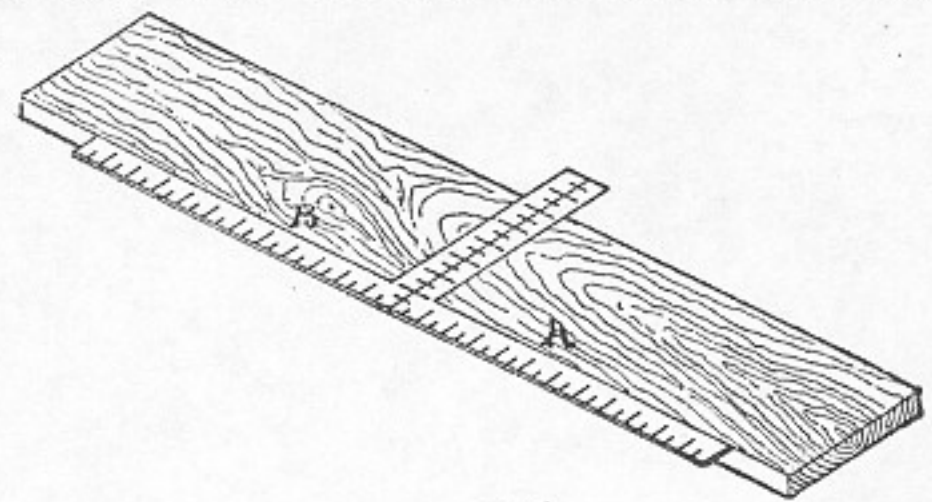
exactly on the edge of the box. This gives the miter cut of the intersection of the angle of a perfect square, as shown in Figure 2. Figure 3 shows the manner of placing the square on the box to give the desired angle.

A sprung molding, which is a molding not solid on the back, as shown in Figure 4, must be placed in the box bottom side up as shown in Figure 5, so as to get a solid bearing to hold it. Cuts in the box to miter around an eight-sided figure or an octagon, as shown in 5A, can be obtained by using 7 inches and 17 inches, marking the cut on the 7-inch side, as shown in Figure 5.

TRUING THE SQUARE

After obtaining a steel square, the first and most essential thing is to test or prove it to see that it is accurate, forming the angle of a perfect square. Take a board planed on one side and straighten one edge of it perfectly as described under Making a

Straight Edge. Make a mark across this board

FIGURE 6
27

with the square, as shown in Figure 6, Position A, then reverse the square to Position B. If the square is true it should exactly fit the mark made. It is necessary to work very accurately, making the mark with the point of a knife and having the edge of the board absolutely straight.

If the square is found to be out or inaccurate, it is not necessary to throw it away; it can be made true by a simple method by any handy mechanic. If you do not possess an anvil, make a substitute by

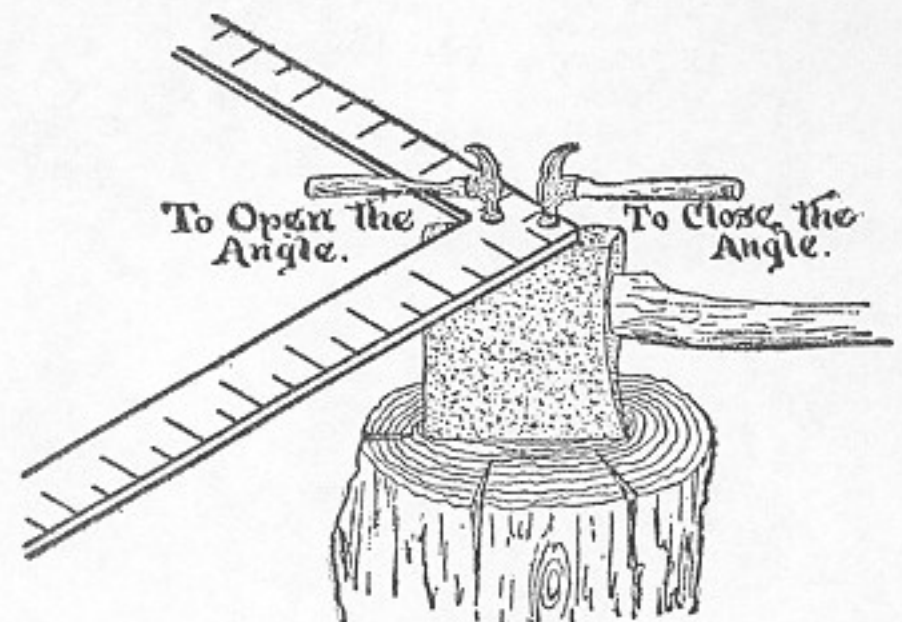


FIGURE 7

sticking the ax into a chopping block, lay the square on the head of the ax so that the bearing will come from the throat or inside angle to the heel or outside of the square. To close up the angle, strike with a hammer a sharp blow at a point near the heel; to open the angle, strike near the throat at a point indicated in Figure 7. Don't strike too hard. Use a bell-face nail hammer and the dent will not be noticed.

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A STRAIGHT EDGE

In connection with the work with the steel square a straight-edged board is necessary to have

ready for immediate use. Procure a board 8 or 10 feet long of good, dry pine, free from knots and 6 to 8 inches wide. Plane the edge until it seems

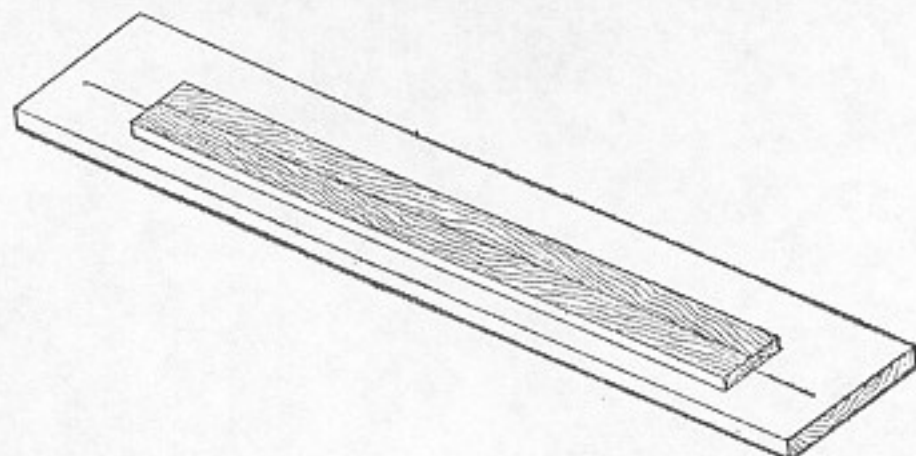


FIGURE 8

straight to the eye, then lay it on the bench or on another board and make a mark along the edge, just straight with a fine lead pencil; reverse it or turn it over and fit it to the other side of the pencil line. This multiplies any inaccuracy or deviation from a straight line. Make a new line each time you plane the edge. Work with as long a plane as you have and set the blade to take a fine shaving. When the edge will fit both sides of the line made from it while in one position, it is straight. Figure 8 will give a clear idea of this operation.

RAFTERS

The common rafter for a pitch roof is easily laid out with the steel square. There are many methods,

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but the easiest and most simple is by spacing. Two dimensions, half the width of the building and the height of the roof, are divided into an equal number of parts. The width of half the building is called the run and is usually divided into parts of 12 inches or a foot for convenience. The height is called the rise, and is divided into an equal number of parts. A glance at Figure 9 tells us that the run there shown is 10 inches rise to 12 inches run.

When the square is laid on the stick to be cut into a rafter, the 10-inch mark on the tongue and the 12-inch mark on the blade are held so that they come exactly even with the outside edge. The blade then takes a level position and the tongue a vertical position or plumb position. This gives the proper level for the cut at the top of the rafter and

the level cut at the top of the plate. As the square now lies on the stick make a fine mark and move the square along, marking another space. Mark as many of these spaces as the parts into which the rise and run were divided. This gives the length of a rafter from the ridge to a point exactly

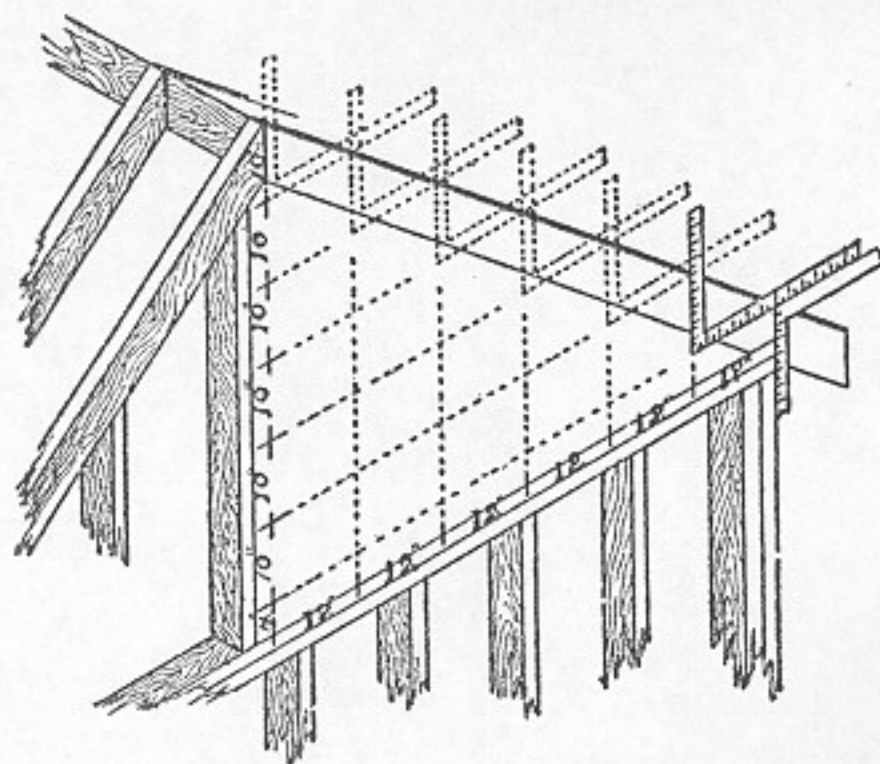


FIGURE 9

30

over the outside of the plate.

Where the rafter overhangs the plate, it is necessary to square down or in to form the notch for the plate. By studying Figure 9 you can readily see the different positions taken by the square, also, how and why the rise and run are divided into an equal number of spaces. By this method the length of the rafter is obtained without use of mathematics.

STAIR STRINGER

The stair stringer is laid out in much the same manner as the common rafter. The total rise of height to go up is divided into parts of about $7\frac{1}{2}$ inches, as near as possible. This makes the easiest step. The run is always divided into one less space than the rise. The reason for this can be easily understood by examining Figure 10. Lay the square on the stick to be used as a stair stringer, taking the numbers into which the rise and run have been divided, mark, and slide the square along until the required number of spaces are marked. A little experience, with allowance made for the surrounding conditions, and any handy mechanic can lay out stringers for an ordinary flight of stairs. To get an easy flight of stairs for the person of average size where plenty of room can be used, experience teaches that $7\frac{1}{2}$ inches rise and 10 inches run or tread makes an easy flight.

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From this some stair-building experts have put together the following rule, which works very well for the average stair: When the rise multiplied by the tread equals 75, the run will be an easy one, as $7\frac{1}{2}$ inches rise by $10\frac{1}{2}$ inches tread

equals 75; $8\frac{1}{3}$ inches rise by 9 inches tread equals

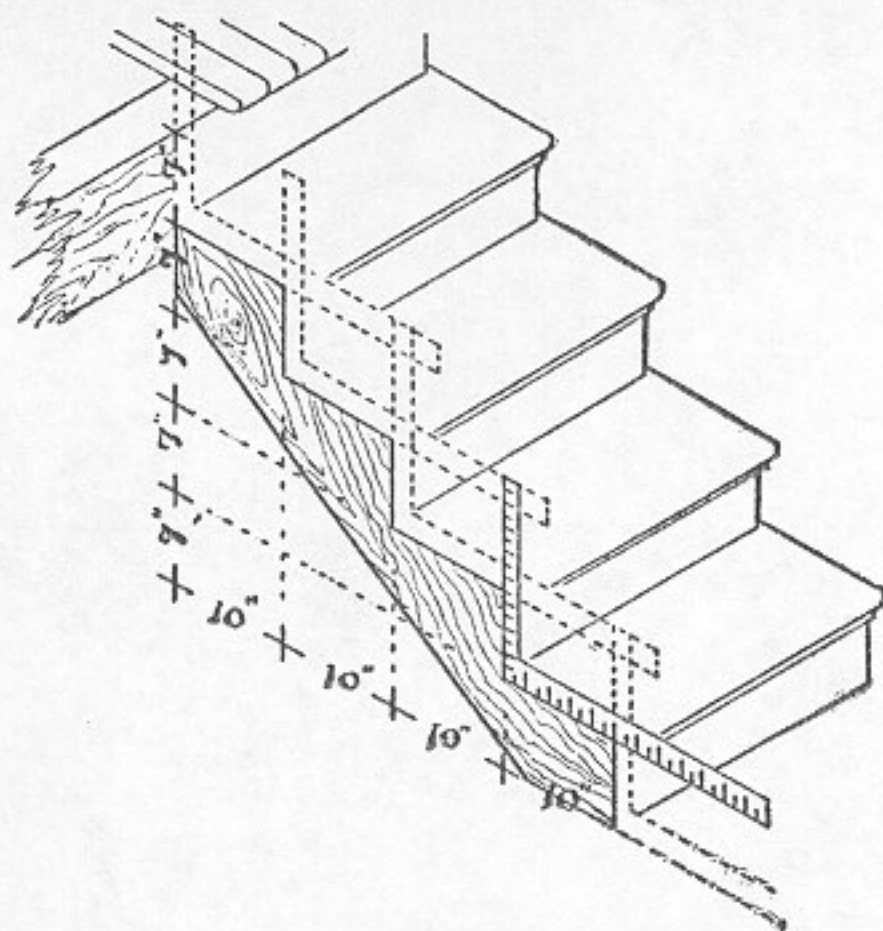


FIGURE 10

75; 8 inches rise by $9\frac{1}{2}$ inches tread equals 76, which is very near the desired result. When the rise is 9 inches or over, the rule is not good, as the tread must be shortened up much more, and the rise should never be more than 11 inches—that is about the rise in an ordinary ladder leaning against a house.

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THE 47TH PROBLEM OF EUCLID

The problem shown in Figure 11 is known as the 47th Problem of Euclid, and is an invention by an

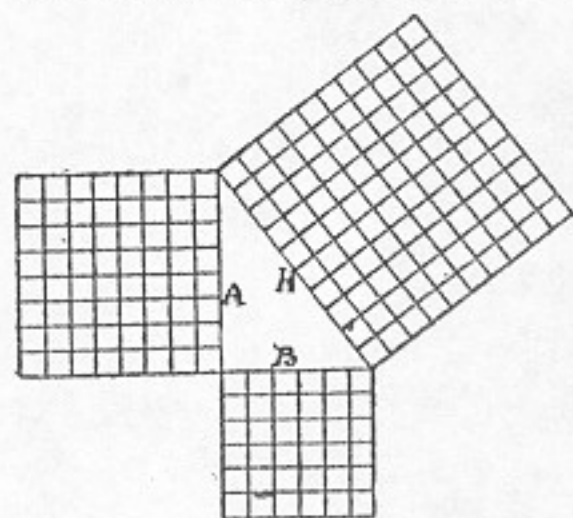


FIGURE 11

ancient Greek geometer who sought many years for a method of finding the length of the hypotenuse of a right angle triangle in mathematics, and when the method was discovered, history tells us there was great rejoicing. Pythagoras is credited with hav-

ing first proved the rule successfully applied to the problem.

The rule is that the square of the base added to the square of the altitude equals the square of the hypotenuse. The base of a right angle triangle is the side on which it rests,

marked B in Figure 11. The altitude is the height and is marked A in Figure 11. The hypotenuse is the connecting side of the triangle, marked H in Figure 11. The base, 6, squared or multiplied by itself, equals 36. The altitude, 8, squared, equals 64. By adding these together we have 100, which is the square of the hypotenuse. It remains but to extract the square root of 100, which we know is 10, therefore 10 is the length of the hypotenuse or third side of this right angle triangle. All right angle triangles can be figured in the same manner, but only multiples of the

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length of the three sides come even—such as 3, 4, 5 and 12, 16, 20, as shown in Figure 12; and many others, of course.

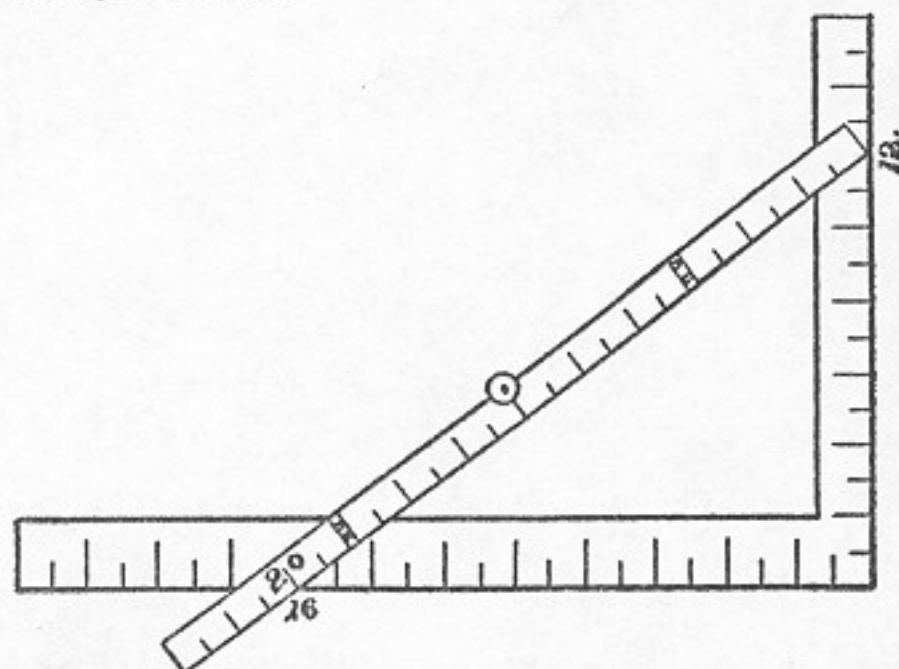


FIGURE 12

THE RULE OF 6, 8 AND 10

This is a rule so extensively used in the building trades and others that it has finally come to be known by the above name. It is derived from the 47th Problem of Euclid, and is used in the manner shown in Figure 13.

Measure 6 feet on the end sill of a building and 8 feet on the side sill. If it measures 10 feet across the angle the building is square. This is a very useful rule and easily remembered. It is always available in running lines for batter boards for masonry or lines for walks. By starting from a corner stake into which a nail is driven, measure off on the string or line used and insert a stake to mark the place. Drive a nail into this stake and

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proceed in like manner on the other side. With a little care and practice, quite a job of surveying can be done by using a few stakes, a ball of string and a tape or 10-foot pole.

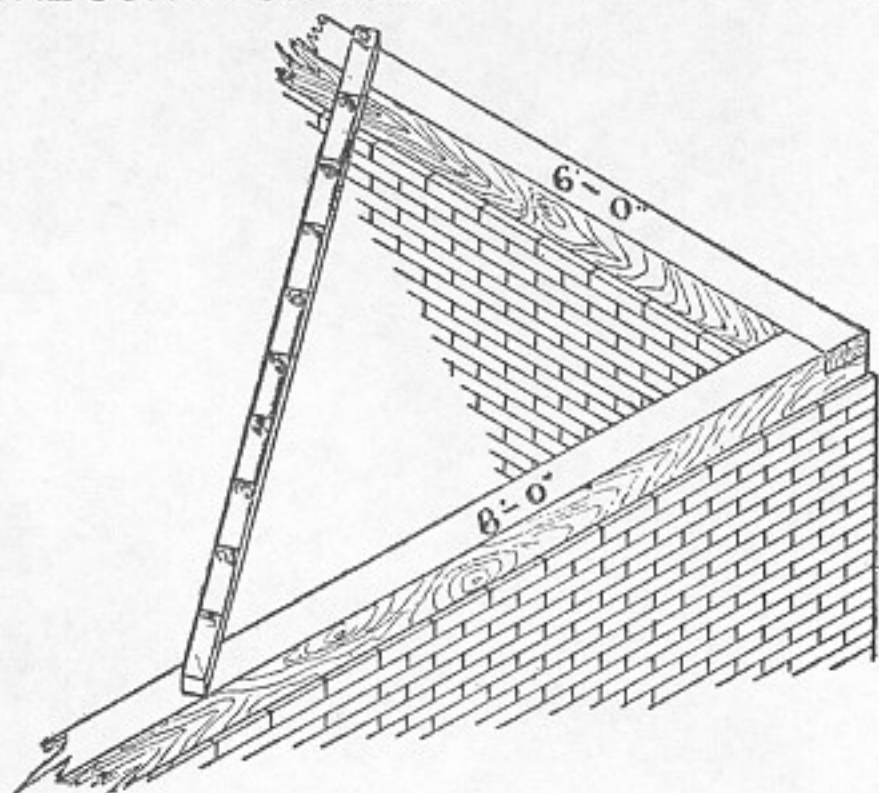


FIGURE 13

ANGLES

An angle is the opening between two lines meeting at a point. Angles are usually spoken of as being of a number of degrees. The degrees are measured on the circumference, the center of which is on the point of the angle. There are 360 degrees of the circumference of a circle. The surface of the earth is so divided north and south by the parallels of latitude, which are numbered from the equator each way; also east and west by the meridians of longi-

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tude, which are numbered from Greenwich, England. They can be seen on any map.

By the use of a protractor, the number of degrees of any angle can be obtained. Figure 14 shows one-half of a circle or 180 degrees.

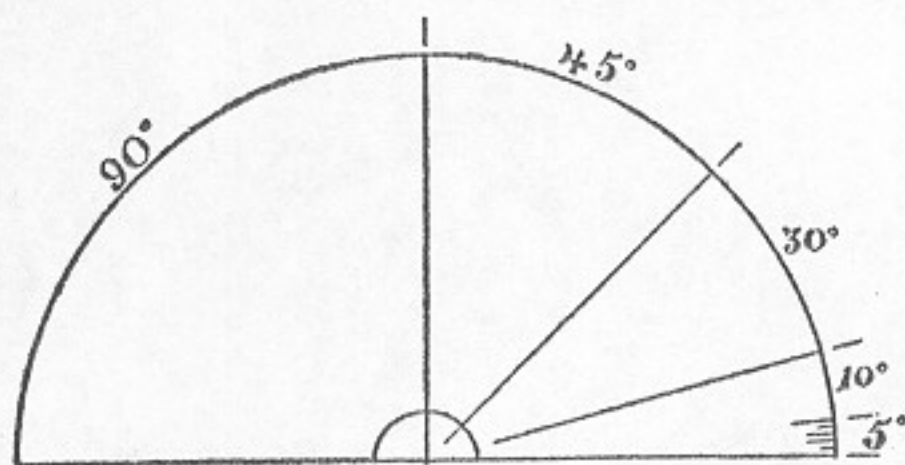


FIGURE 14

PLOTTING ANGLES

To strike an angle in a field on a large scale where one line is given or can be obtained, measure off from the point of the angle $57\frac{3}{10}$ feet; lay one

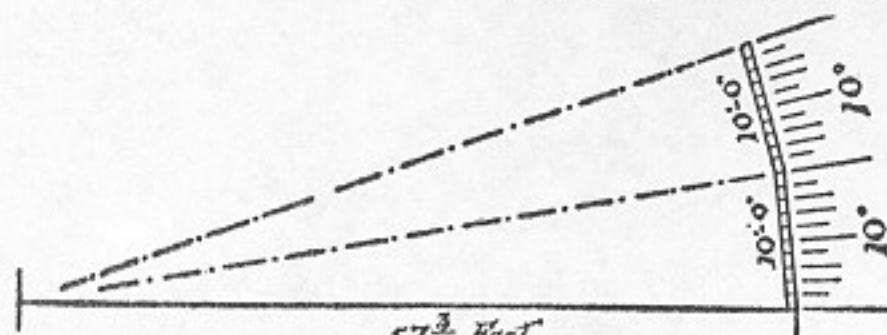


FIGURE 15

end of a 10-foot pole at this point. The other end should be swung around so that it also will be $57\frac{3}{10}$ feet from the starting point. Each foot marks

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off 1 degree on the circumference of a circle whose radius is $57\frac{3}{10}$ feet. If more than 10 degrees are required, continue as before, keeping the ends of the 10-foot pole always on the circumference of the circle from the starting point. A clear idea of this operation can be obtained from Figure 15.

IN and AROUND the HOUSE

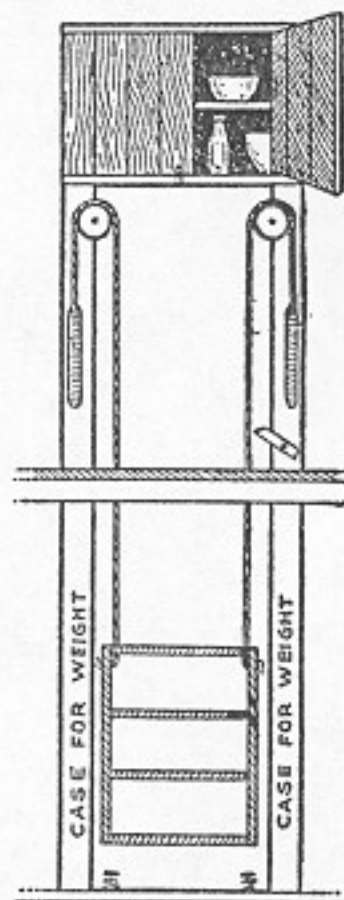
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THE STEP-SAVING DUMB WAITER



ONE may save many steps in every house where the kitchen is situated over the cellar, to say nothing of other considerations, with a small outlay of time, and perhaps, without the expenditure of a single dollar, by

means of a dumb waiter, which may be placed in any convenient corner out of the way. A handy size for an ordinary family is 2 feet square with four shelves, counting the top, 1 foot apart. These shelves may be hung from the corners, the center or the middle of the sides, by means of manila sash cord over pulleys placed close to the ceiling of the kitchen and nearly balanced with weights, which should be confined in a little case. They should be guided in ascending and descending by means of grooves in the middle of the sides extending from top to bottom of the inclosed case. In the cellar the case may have a fine



DUMB WAITER

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wire screen door and in the kitchen an ordinary cupboard door or one with a glass front, as desired.

The doors should slide upward and be balanced like an ordinary window with sash weights and pulleys. In order to prevent the waiter from descending when being overloaded a pivoted wooden latch, as shown on the right-hand side, should engage with the ends of the shelves, and to prevent any shock from too quick descent some coiled springs should be placed at the bottom of the case. If desired a small cupboard may be built at the top of the case for storing little-used articles.

Some advantages of such a waiter are that food may be placed on the shelves and lowered into the cool cellar and either allowed to stay there or removed to the refrigerator. Thus it will be unnecessary to carry anything to or from the cellar, and this will often mean a saving of several trips up and down. If the cellar is clean and cool there may be no need to use a refrigerator or an ice box.

RACK FOR PRESERVES

A convenient rack for preserves may be made just at the turn of the cellar stairs in a house, so that the housewife need not step off the stairs, when she descends for a can of preserves. Several circular pieces of wood are pierced through the centers and nailed to a kind of wooden shaft that runs through the entire rack. Nail barrel hoops of the thick, wide variety around the edge of the shelves, so that the contents cannot fall off. The barrel hoops are soaked in water for several hours to make them pliable, so they can be fitted around the shelves.

In a socket at the bottom, the middle shaft slips, the upper end working in a socket in the end of a stout piece of wood nailed to the beam overhead. The sockets may be purchased at the hardware store. The glass cans are arranged on the shelves, and the housewife can stand in one spot and turn the rack around until she finds the jar for which she is looking.

From the covers of large cheese boxes anyone could make a similar rack, using it in attic or kitchen, anywhere where one wants a rack which will hold an extra large number of articles for the amount of space involved.

TRANSFORMING A WASHSTAND

The kitchen cabinet here shown was made from an antiquated washstand and table, using old lumber, odds and ends of varnish, nails and screws, the

finished article costing less than 50 cents. The only tools used were a saw, hammer, plane and square, such as can be found in any farmer's collection.

First, the shelf shown in Figure 1 was made, it being wide enough to reach each end of the table and deep enough for the washstand to set on it flush. To the right end was screwed a board of the same width, the shelf being so placed that it would be 2 feet above the

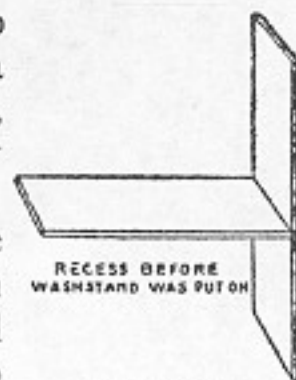
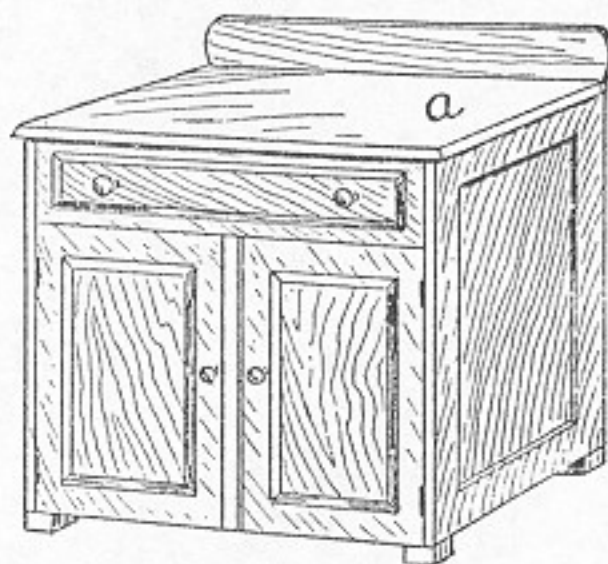


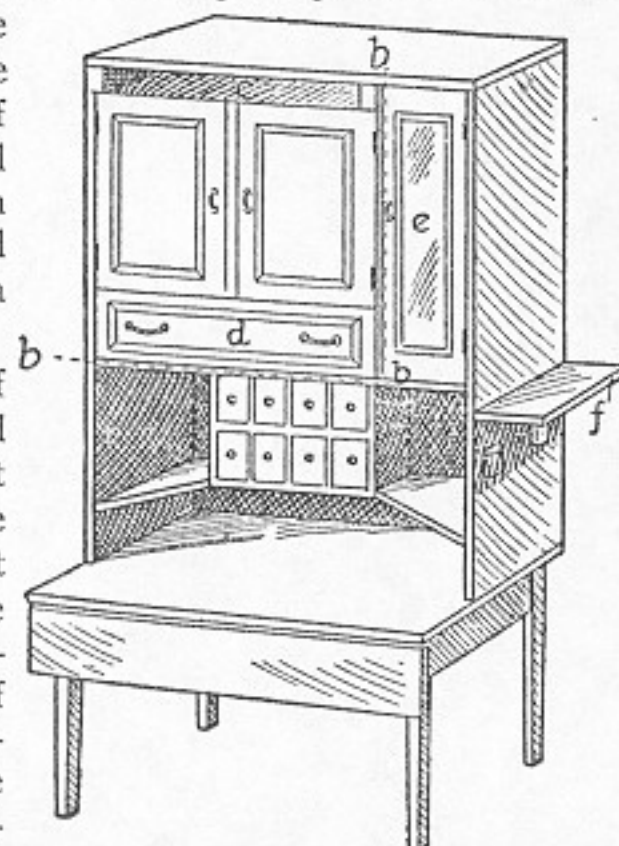
FIGURE 1



WASHSTAND AS IT WAS

table. A board of equal width formed the support at the other end. Then the washstand, from which the top had been removed, was placed upside down on the shelf (bbb), one end of the washstand reaching to the extreme left end of the shelf, and the two were securely fastened together. This left a narrow open space between the right end of the washstand and the right support of the shelf. A board was then nailed on top from one end to the other, and a back added.

The drawer of the washstand had to be fixed so that it would slide the other way, as it was now upside down. That necessitated a shelf inside the washstand above the drawer. Old lumber was used, and



THE COMPLETED CABINET

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this was smoothed with a plane, then sandpapered and holes and cracks filled with putty. When the putty was dry it was sandpapered again.

A support was then nailed to the back of the recess for a spice cabinet. This left the cabinet about 4 inches from the table. This support also

did for two shelves, one in each corner of the recess. The spice cabinet contained eight small drawers and added much to the whole. A door with a glass sash (*e*) was then made for the narrow space to the right of the washstand above the recess. This made a little china closet with two shelves and containing over a dozen brass cup hooks. The space near the top on the left-hand side, between the short legs of the washstand, was left open for the crumb and draining trays. A piece of batten was nailed around the top as a finishing touch.

A leaf, which could be raised when required, added to the table room. The cabinet being placed in a corner left the front and one end free. On this end or side were placed two salt boxes, one for salt, and the other for kitchen cloths. Directly above these and reaching the length of the end was a shelf (*f*) for the clock, etc. Finally, walnut varnish stain, two coats, was applied. In each side of the recess were screwed two large cup hooks. Similar hooks were screwed on the inside of the washstand doors, to hang up biscuit cutter, corkscrew, nutmeg grater, etc.

HOMEMADE DRESSER

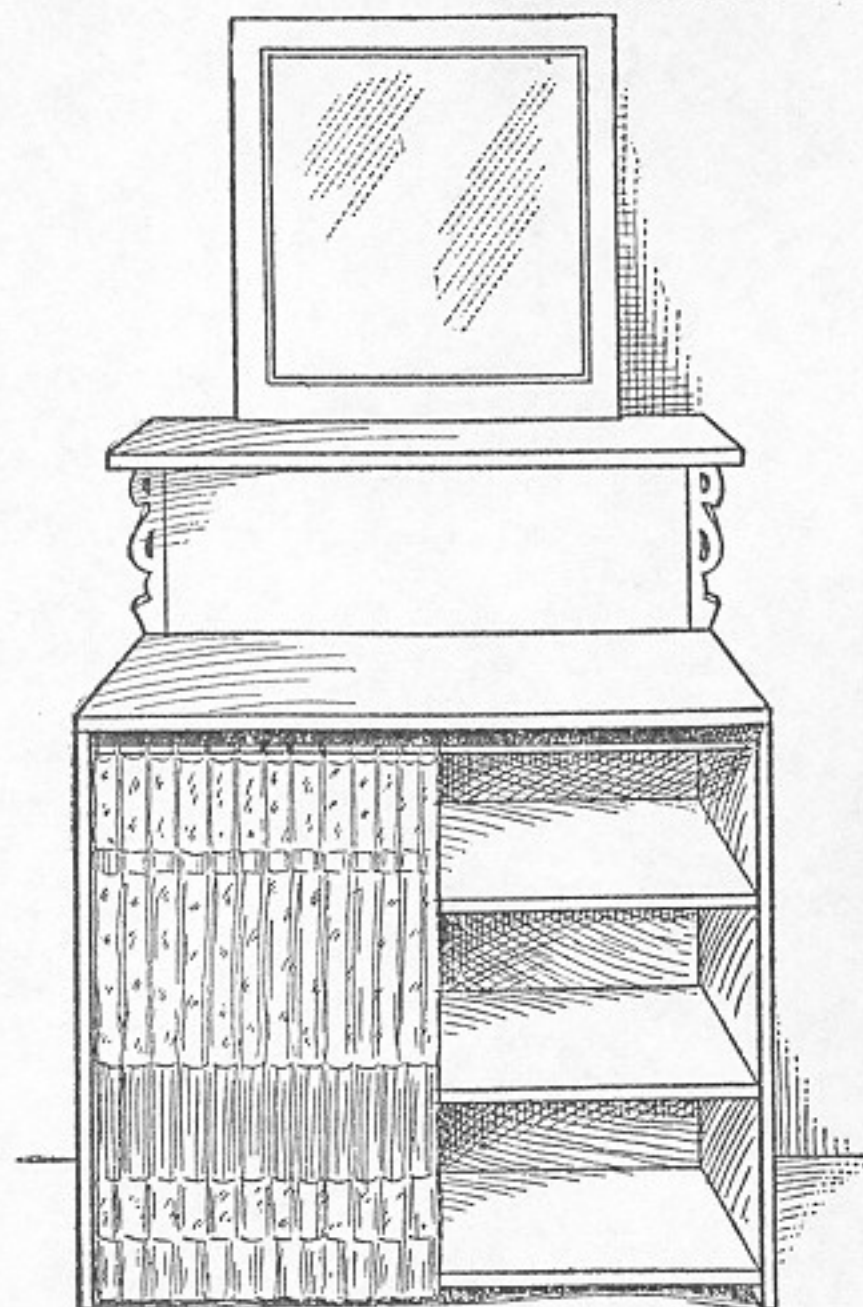
Sometimes it is necessary to use homemade makeshifts in the house furnishing, and sometimes it is done through a desire to exercise one's in-

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genuity in fashioning simple affairs. The accompanying illustration shows a plan for making a simple dresser that when finished will not only be very useful in itself, but will also add a useful bit of furnishing to the room.



KEEP THE HAMMER BUSY



DRESSER MADE FROM A BOX

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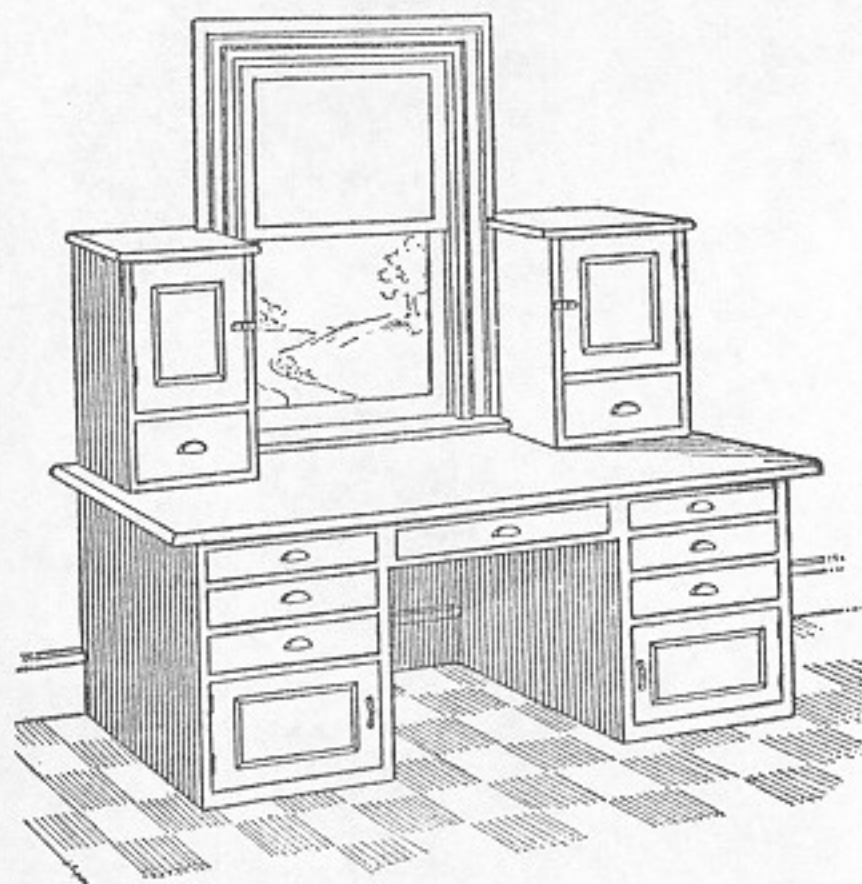
Select a drygoods box of the right size to fit well into the space to be utilized, then fit two shelves to the interior, as suggested. The whole box should be covered on the outside with some pretty cloth, the edges being drawn over and around the front edges of the box, and neatly tacked inside. Make a shelf with a length equal to the width of the box and fasten it to the wall above the box with some pretty nickel brackets, as shown in illustration. Cover the shelf with cloth, also. Now place a looking-glass above the shelf and have a curtain like the covering in front of the opening. This curtain can have little brass rings sewed to the upper edge, which will slide on a small brass rod.

KITCHEN WINDOW CABINET

Nothing lightens labor so much as cheerfulness, and cheerfulness may often be secured by very simple means. In the accompanying picture is shown one way that works well. Instead of the usual kitchen table a cabinet is built below and at the sides of the kitchen window and the top made large enough to serve as a table. In this way the

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wife may have a pleasant view when she looks up from her kitchen work. It is not necessary to go into details concerning the construction of such a cabinet, because no two people would be satisfied



CABINET AT WINDOW

with the same plan. The plan shown is merely suggestive for the thoughtful wife and the handy man to work out to suit their own particular needs.

TO LET IN MORE LIGHT

Many farm kitchens and dining rooms are dark and gloomy. It is not an easy matter to cut new windows in the outside wall, though this can often be done to great advantage;⁴⁵ but where there is an outside door in a dark room, conditions can very easily be improved, and that, too, at small expense. Doors vary greatly in the manner of construction, some having wide panels at the top and some having two narrow ones of varying lengths. But almost every panel door that was ever constructed can be treated in the way which we will describe. The two upper panels can be removed, and their place filled with two lights of glass. If the door is of modern make it will be found that the wooden panel is held in place by a narrow molding all about it, both inside and out. Remove the molding on one side, and take out the panel. Put in the glass and replace the molding, and the work is done. If, however, the door is of older manufacture the molding on either side may be found to be a part of the door frame. In this case, cut the molding away

on one side, neatly and evenly, and remove the panel. Then insert the glass, and having made, or bought, a little strip of molding, fasten it neatly in place around the glass with brads.

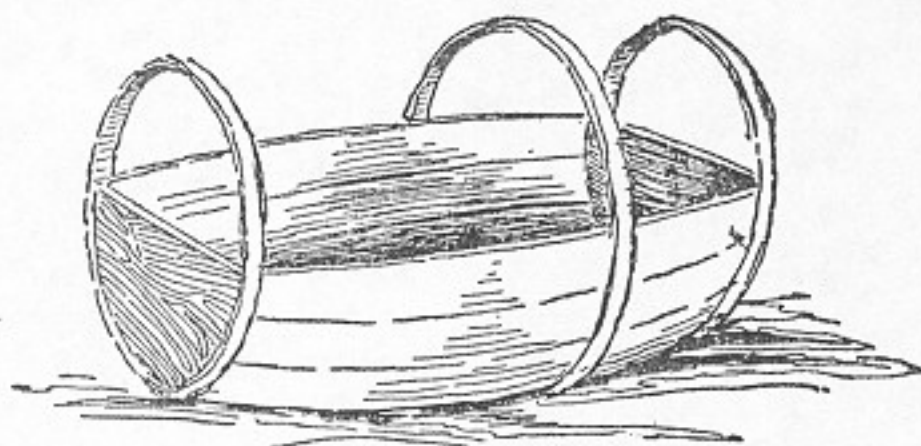
In the case of some doors the two panels could be removed, and also the upright between them, leaving a large rectangular opening, into which a single sash of four, or nine, lights could be inserted, the joints being made tight about it with putty and white lead. Then tack a narrow bit of molding about the sash, both inside and out, and a door that will give light to the room will be the result. An outside door looks better with glass in the upper half, and the interior will certainly be made more cheerful and healthful because of it.

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A BARREL CRADLE

Anyone who can use a hammer and nails and needle and thread can make this inexpensive, accessible, easily moved, and cool yet sheltering cradle.

Secure a nice white sugar barrel, clean it thoroughly and remove half of both heads. Place the barrel on its side, removing half the staves, and leaving the other half to form the bed of the cradle.



BARREL READY TO TRIM

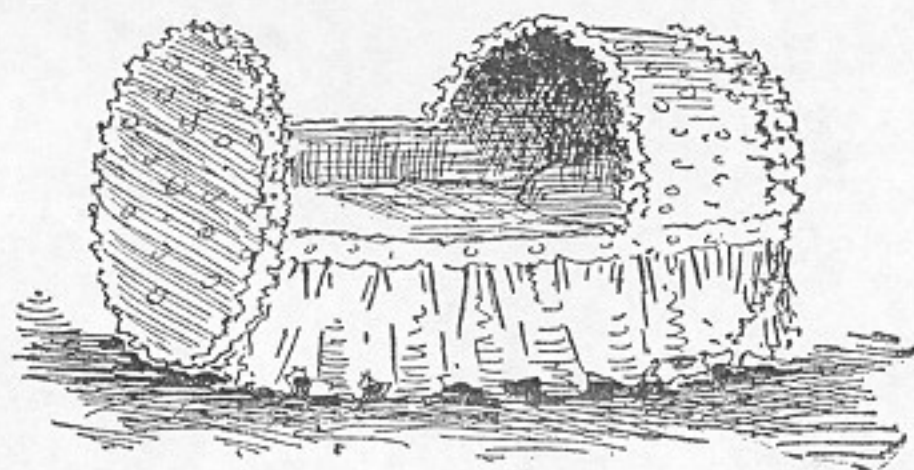
Next remove the hoop that is second from the bottom, and then two hoops will be left at the top to form the frame for the hood, and one hoop at the bottom to form the foot. (See illustration.) Carefully nail the remaining staves to the hoops, clinching each nail securely.

Now cover the frame thus formed, as shown in the accompanying illustration. Any thin cotton goods that may be laundered can be used. Figured lawn would be very pretty, and if economy is an item, a worn bleaching sheet will do. Place a little mattress or pad and a tiny pillow within, or

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the usual cradle furnishings may be used. One yard of mosquito netting stretched over the opening of the cradle will prevent insects from bothering, and

the netting itself cannot touch and awaken the baby.



FINISHED CRADLE

TO PROTECT BABY FROM HOT STOVE

Winter months mean extra care for the mother of a baby, but possibly the greatest of the additional cares that winter brings in this regard is that of keeping the curious tot from the hot stove. Build a pen around the stove to protect him from it. The pen is a simple affair. It consists of four little gates, made just large enough to surround the stove, and covered with netting. The wire netting does not interfere with the free passage of heat and is very effective in keeping baby from getting burned. The gates are made of $1\frac{1}{4}$ -inch strips, mortised or neatly fitted. For netting use ordinary poultry wire of 2-foot width. The gates are held in place by hooks and screw eyes. This arrangement is better than hinges, as it makes the

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taking down of the affair, for sweeping or cleaning the stove, much easier.

In the summer you may use the gate at the foot of the stairs, across the porch door, and in other places where baby is determined to go, and where he is in danger of falling and getting hurt unless protected in this way. For this pen, the lumber costs 25 cents, the netting 25 cents, and the hook and screw eyes 15 cents, making a total of only 65 cents.

A BOX FOR CLOTHES

In many of the furniture stores one may see pretty cloth-covered boxes that are used in bedrooms as a receptacle for various articles of apparel, the inside, as well as the outside, being covered with pretty figured cloth. The inside of the cover is fitted with pockets for slippers and slumber shoes. These little chests are so light that they may be lifted about with one hand.

To make such a chest, select one of the very light and well-made grocery boxes in which cereals and various brands of breakfast foods are shipped, which may be had at any grocery store. See that the corners and the bottom are nailed securely. The top will be composed of at least two pieces of board, and these can be made into a solid cover by nailing two cleats beneath them. But these will not look very attractive when the covering is being put on, so a more workmanlike plan will be to saw off a couple of inches from each end of the top boards and supply the place of the wood removed by nailing along the ends a 2-inch strip of the same thickness. This gives a cleat at each end, but the cleats in this way form part of the cover itself.

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Use long wire nails to secure these end pieces in place.

It will be a simple matter to cover and line the box when the covering material is at hand. Use very small tacks and carry the outside covering up over the top and down over the inside, which will make the use of tacks along the top unnecessary. The lower edge of the cover can be tacked on the bottom of the box, so the tacks will not be seen on the outside at all.

SCOOPS FROM TIN CANS

Scoops for handling sugar and flour are among the most convenient utensils that one can have about the pantry; and in a short time a good supply may be made from materials that are going to waste about almost every home.

Take an ordinary tin can and either melt or cut off the top. With a pair of tinner's shears (a strong pair of household shears may be used), begin at the open end and split the side of the can to within about an inch of the bottom. Opposite this one make a similar slit. Parallel to the bottom of the can, cut from the lower end of one slit to that of the other. Round the corners of the remaining half, and the body of your scoop is finished.

For a handle, about 4 inches off the end of an old broomstick is just the thing. If this is not available, a handle may easily be shaped with a knife from a piece of soft wood. To attach the handle, from the inside drive a small nail through the center of the bottom of the can and into the center of the handle.

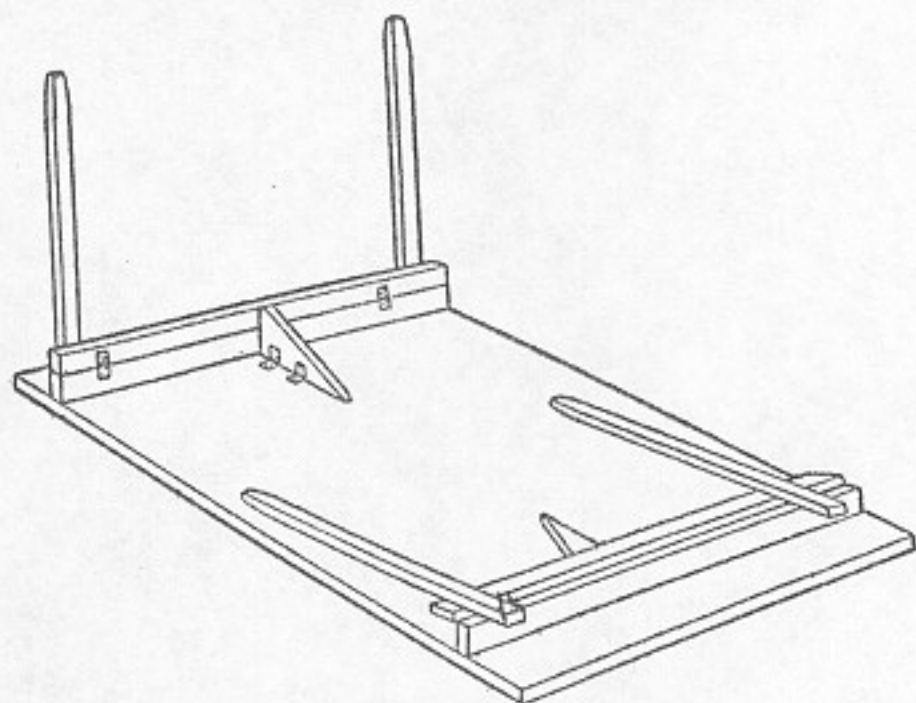
50

Some additional strength is obtained by planning so that the seam of the can will run down the middle of the lip of the scoop, thus stiffening it. A

salmon or corn can makes a very convenient sized scoop for the sugar, while tomato cans serve very nicely for flour and meals, and half-gallon paint buckets may be thus utilized for handling light materials.

A HOMEMADE FOLDING TABLE

A handy game or sewing table may be made as follows: Take two planed boards 12 inches wide and 3 feet long. Fasten them together with two



SIMPLE HANDY TABLE

strips 2 inches wide and 24 inches long. Fasten these strips by strong screws in upright position. Now take two similar strips and fasten them by

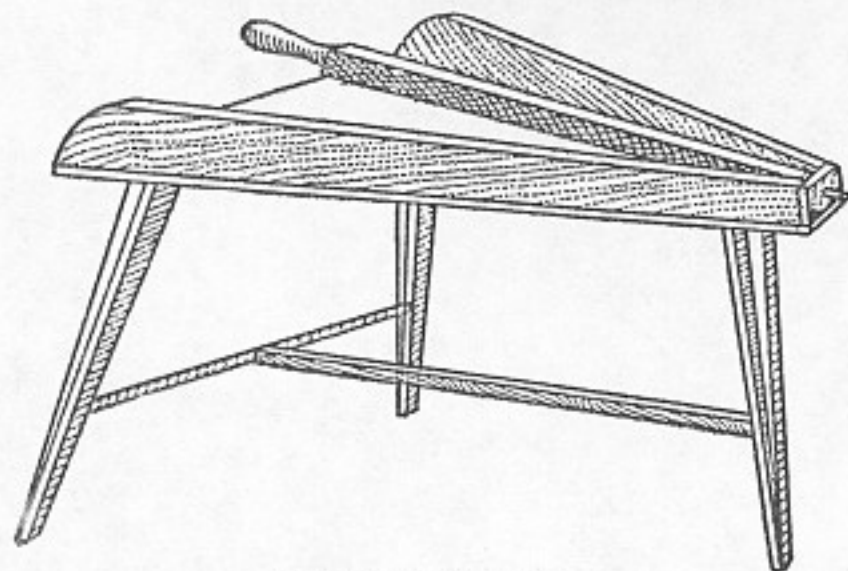
51

hinges to the pieces screwed on the boards. Fasten four stout legs to these in the manner shown in the cut. Take two three-cornered boards large enough to hold the legs stiff when dropped into position, and fasten them by hinges, as shown.

The same general plan may be followed in making a much larger and heavier table or a lighter one.

A HOMEMADE BUTTER WORKER

A butter worker is one of the handy devices that should be upon every farm. A good type is shown in the drawing. It is made of close-grained hardwood—maple or birch are recommended—tight-jointed, free from knots and perfectly smooth in size. It slopes enough to drain readily at the narrow end through a short piece of lead pipe inserted at the bottom. The working bar has a strong, smooth iron rod or spike at its lower end, which is easily inserted into or removed from the hole in which it works. The part of the bar that comes



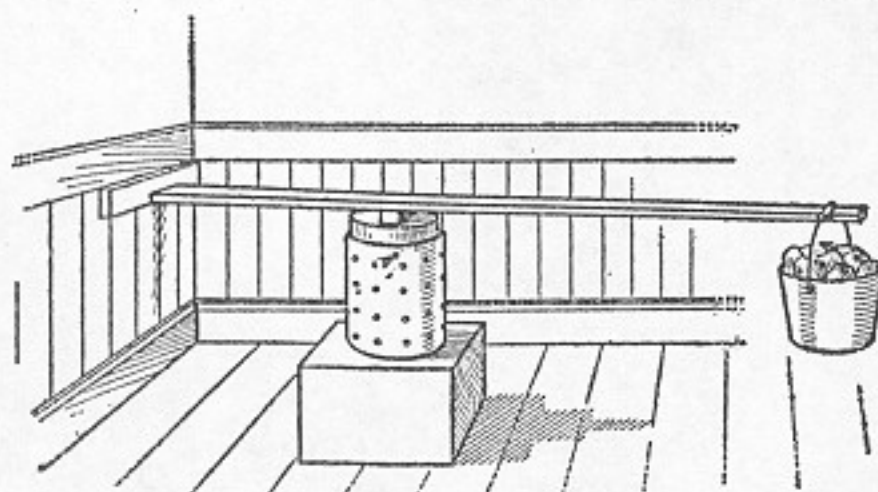
BUTTER WORKER

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in contact with the butter is half-round on one side and two flat sides meet at a right angle. Of course, it must be as smooth as possible.

HOME CHEESEMAKING

Nearly every farm home contains, or may easily be supplied with, the necessary appliances to make cheese, and it is not a difficult task when one is once familiar with the process. For a small batch of about 12 gallons of milk the following method is a good one: Take about 6 gallons of the evening's milk and leave it covered with a cloth in a



CHEESE PRESS

temperature of 65 to 70 degrees until morning and then mix 6 gallons of morning's milk with it in a large tub or boiler. All milk may then be heated together to 80 to 90 degrees. Care must be used not to get it too hot or to expose it to a draft so that it will cool quickly.

Another good method preferred by some is to use 11 gallons of perfectly sweet morning's milk and

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to this add 1 gallon of milk that has soured and thickened. The sour milk should be stirred well to get out all the lumps and left for about 15 minutes before the rennet is put in. The easiest way to heat the milk is to place it in a wash boiler

right on the stove until it gets up to 86 to 90 degrees and then raise it from the stove by placing it on two bricks. The stove must not be too hot.

Rennet in the form of tablets is most convenient and useful for home cheesemaking. Dissolve one tablet in half a glass of cold water and add to the milk after it has been heated and stir well for two minutes. Some cheesemakers use two or three tablets, as it saves time, but for beginners two are usually enough. If you have liquid rennet extract, use about two tablespoonfuls.

Cutting the Curd

The rennet will curdle the milk and the curd will be ready to cut in 20 to 40 minutes. This can be determined by noting if the curd breaks clean like jelly when raised on a knife blade. The cutting can be done with a wire-toaster, a long knife or a heavy wire. Cut lengthwise of the vessel and then crosswise until the curd is in nearly uniform pieces of $\frac{1}{2}$ -inch squares. After cutting, leave the curd on for five minutes, then heat slowly to 100 degrees, stirring all the time. Cook for about 40 minutes at as near 90 degrees as possible, stirring occasionally to prevent the curd from sticking together. Keep the heat up and do not allow the mass to cool.

To determine when the curd is ready, take a handful and squeeze it in the hand firmly and if it feels elastic and does not stick together, it has been cooked long enough. If the milk is good, the curd

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should have a pleasant, slightly acid odor. As soon as the curd is cooked, draw off the whey or dip off the curd with a sieve and place in another vessel. After the curd is well drained and before it sticks together, add $\frac{1}{4}$ pound of fine salt and mix well. After salting, let it cool for 15 minutes, stirring occasionally, when it is ready for the hoop.

Pressing and Curing

For a cheese hoop, one can use a tin hoop 7 inches in diameter and 12 inches deep or an old peck measure without a bottom if holes are punched in the sides for drainage. For a press a device shown in the sketch will serve well, the pail at the end of the lever being filled with stones. Before the curd is placed in the hoop, line it with cheesecloth, one piece the size of the bottom and another around the side. Turn the upper edge of the cloth over the edge of the hoop and fasten it tight. When the curd is packed firmly, put a piece of cloth on the upper end and fold it over tight. Make the pressure slight at first, but after an hour rearrange the cloth and

make the pressure heavier. The pressing should be finished by the next day. Do not press in too cool a place, but keep the temperature about 50 degrees.

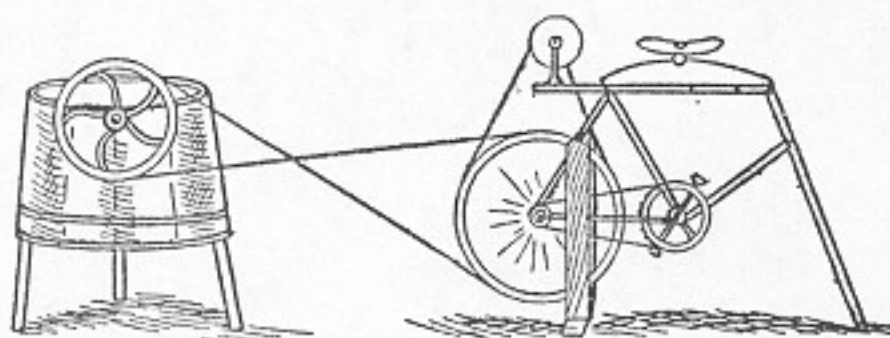
For curing, set the cheese in a damp room or cellar which has an even temperature. Turn it around daily, and if it shows signs of molding, rub occasionally with butter. It should be ready to eat in three or four weeks. Cheese will cure at 40 degrees, but it takes longer than when warmer. Twelve gallons of milk should make about 10 pounds of cheese, according to richness of milk.

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After one or two attempts any housekeeper should be able to make good cheese by this method. It is necessary to keep all utensils very clean and the liberal use of boiling water with a little soda will accomplish this purpose.

WASHES WHILE READING

Here is a way of making play of wash day. Perhaps some of our bright boys will try this to help mother. A friend of ours had an old bicycle unfit for use. He made a frame to raise the hind wheel from the floor, wound the rim with twine (tire being off) and reversed the seat. In place of the form he inserted a piece of pipe (a stick would do as well). Then he took some old belting, cut it



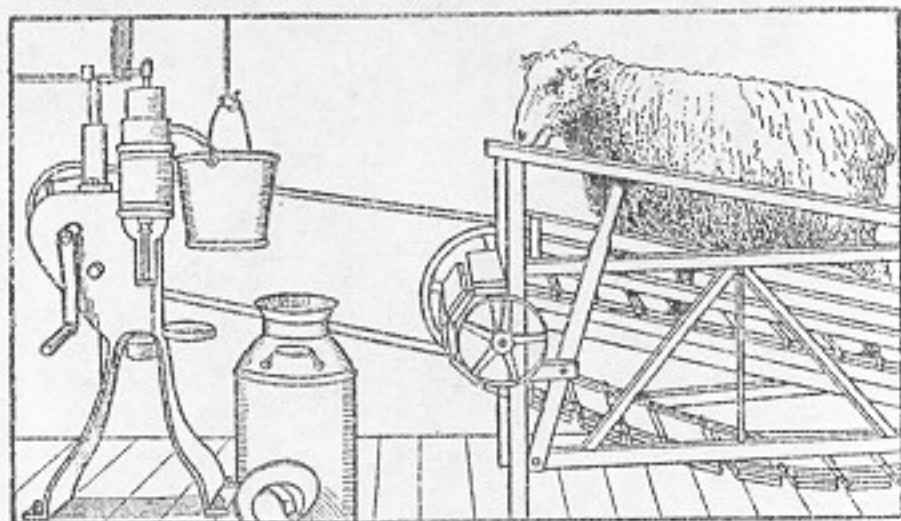
PEDAL POWER DEVICE

to $1\frac{3}{4}$ inches wide and about 10 feet long, and with that he runs the washing machine for his wife. He can read the paper while he washes, and he does not lose much time from field work either. An emery wheel can also be run with it by bolting 1-inch strips to the top part of the frame extending over the wheel and mounting a polishing head on same.

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TREAD POWER IN THE DAIRY

While the small gasoline engines adapted to running cream separators have been hailed with delight by many dairymen, the old tread power is still a very economical and reliable source of power. With a heavy sheep, dog or the dairy herd bull enough power can be produced to run the sep-



SEPARATOR RUN BY RAM POWER

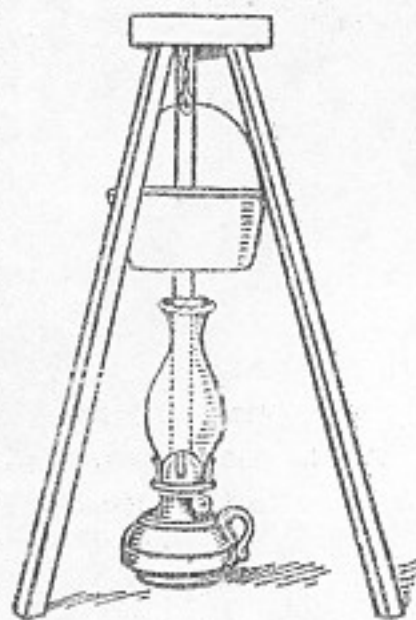
arator and churn at practically no cost except for the tread.

One difficulty has been to secure a uniform rate of speed, but this is solved if a heavy flywheel is attached to the tread. While the sketch shows a direct drive from tread to separator, a more desirable arrangement is to have the tread located in a room adjoining the separator room, where the milk will not be exposed to the breath of the animal.

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A LAMP FOR COOKING

A lamp may be utilized for cooking purposes in the following way: Make a tripod by taking three strips of wood of equal length, putting in one end a headless nail and making slightly slanting holes in the corners of a 6-inch triangular piece of board in which to fit them. A screw hook in the center of the board, on the under side, completes the device, which has only to be stood over a lighted lamp to be ready for work. A small stew kettle, or tin pail, hung on the hook, within a half inch of the lamp chimney, enables one to have a "pot boiling" in short order. If you have a large lamp, with a round wick, it will give the heat of two or three common ones, and you can cook almost as rapidly as over a stove.



LAMP HEATER

With an ordinary lamp, food can be heated, eggs boiled, or coffee made very quickly, helping wonderfully in the getting of a meal. This is also an easy and convenient way to heat baby's milk, or water, in the night, in case of sickness. Stood on a chair by the table, the device can be used to keep the coffee or chocolate hot during meal time. A round piece of sheet iron, with chains attached to

suspend it from the hook, is an additional help, to hold a steeper for tea.

As this tripod can be taken apart readily, when not in use, it will be found a good adjunct to a

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camping outfit, even though you carry a camp stove, for there will be times when nothing will be wanted but a hot drink, which can be made over the lamp with less trouble than it would be to make a fire in the stove.

HOT WATER ALL NIGHT

One of the things that must be had quickly when medicine is needed, and still more often for a bottle baby, is hot water at night. The following contrivance has been found to be worth many times the trouble to make it, for it saves annoyance at a time when baby's worrying may mean hours of sitting up.

Place the socket of a wall bracket lamp just high enough above a table so that the top of a hand lamp chimney will be 5 or 6 inches below it. Make an arm of round iron or small piping long enough to extend out over the lamp and to this hang a hook, on which hang a small teakettle or pail. In this enough water for the needs of a night can be kept hot without boiling, and will be ready at an instant's notice. As a night lamp is a necessity in a house where there is a youngster, the cost of this device will be nothing, for the blaze of a small burner will provide sufficient heat. The proper height for the socket on the wall can be determined by measuring the hook and the kettle to be used. The lamp chimney should not be nearer than 2 inches to the bottom of the kettle, or the water will boil and steam away.

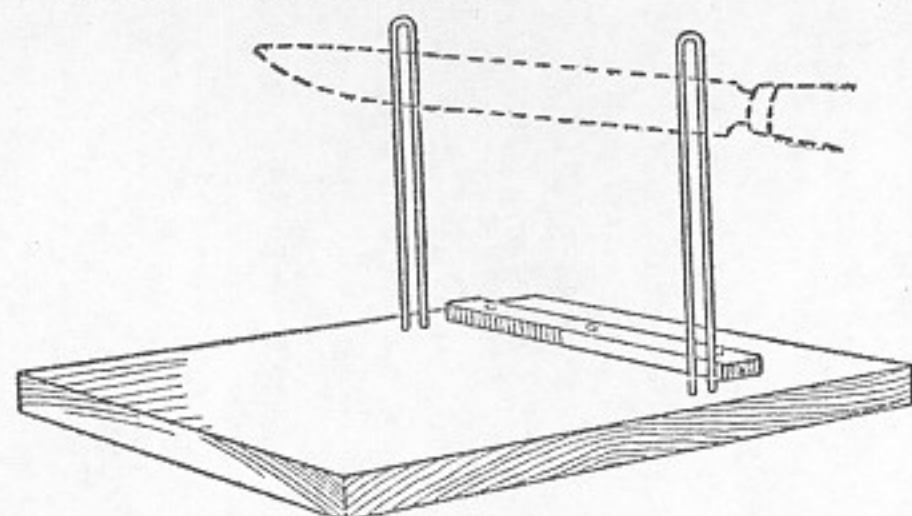
HOW TO CUT BREAD EVEN

Here is one of the most useful devices to which the handy man can give his attention. It is very

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rarely that a housekeeper can cut even and handsome slices of bread, however much she may desire to have the bread plate look attractive. One slice will be thin, another thick, while another will be thick on one edge and thin on the other. The drawing shows a simple arrangement by which all the slices of bread can be cut of an even thickness without any slant.

Cut a piece of pine board to about 9 x 13 inches. Near one end, on either side, insert firmly two pieces of very stout wire, bent double, as suggested in the cut. These wire supports should be at least 7 inches high, and should have another inch of length firmly inserted in the wood. The wire



BREAD CUTTING BOARD

should be as stout as No. 12, or larger still, and should stand exactly at right angles to the board. Put them far enough apart so the largest loaf will readily go between them, and have the opening in each wire standard just wide enough so the knife will slide up and down without "wobbling." The dotted lines show the position of the knife when

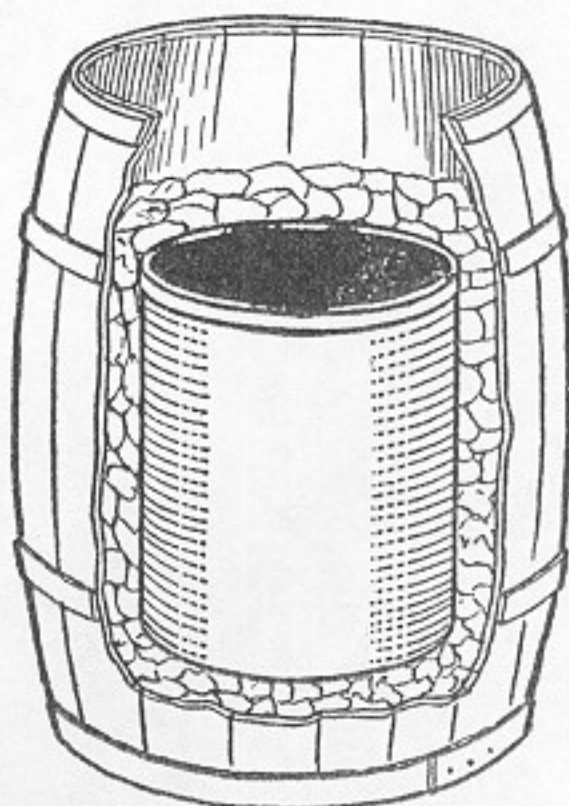
60

in place. Screw a little strip of wood in front of the wire, just far enough ahead to make the slice of bread the right thickness. Press the loaf up against this guide and cut off a slice, then press the shortened loaf up again, and repeat the process.

HOMEMADE WATER COOLER

It's a mighty nice thing to have a good supply of cold water at the barn when threshers, corn

huskers, or hay harvesters are at work. A simple and effective arrangement can be made by using a flour barrel and a 10-gallon stone jar. Place the jar inside the barrel and surround it with charcoal, sawdust, or chaff, if nothing else is available. With a tight lid and a wet cloth spread over the top, water will keep ice cold in this arrangement.



WATER COOLER

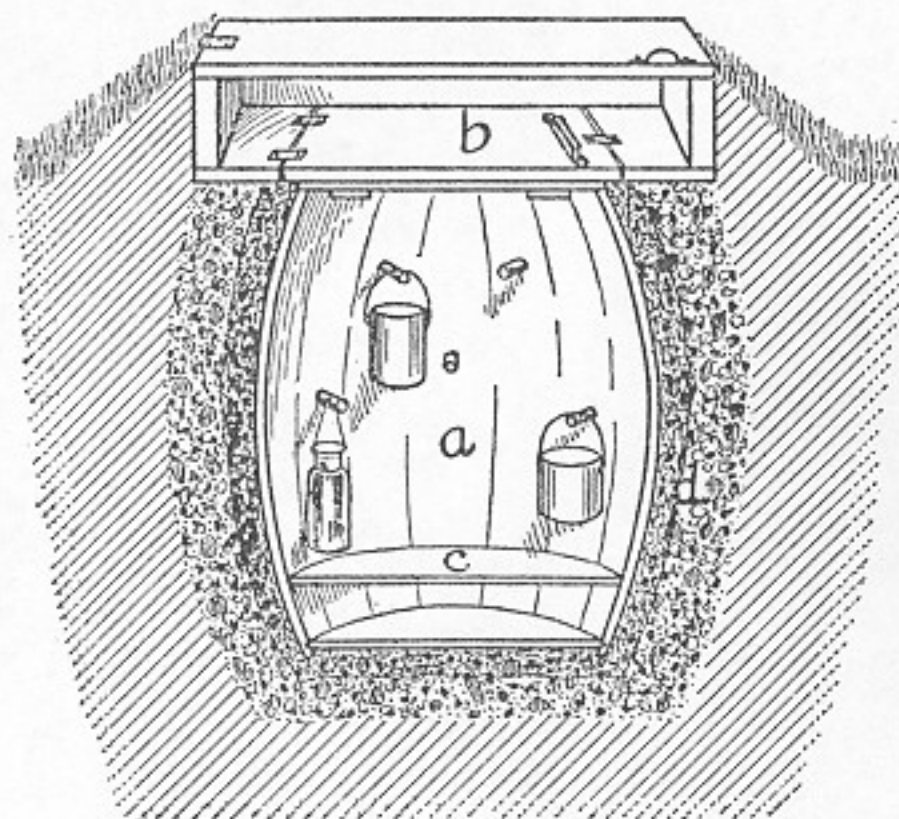
The uses of such a cooler may be multiplied to include keeping many things cool in the house.

KEEP FOOD COOL IN SUMMER

A very convenient and serviceable place to keep

dairy products may be formed by sinking a large barrel in the ground. A shady spot should be chosen, or the heat of the sun will affect the temperature. Fill in around the barrel with small stones, gravel and sand, dampened in order to maintain coolness.

Construct a box around and above the top of the barrel, and bank up with solid earth, preferably



FOOD COOLER

clay. This drains off the water when it rains. It also makes the bottom of the barrel farther down from the top of the opening, which further promotes coolness. Next shape a light, inner lid to place on top of the barrel, and then make a strong, hinged lid for the box, and arrange it so it may be fastened down tightly.

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Sprinkle a little dampened sand on the bottom of the barrel, and your little barrel cellar is ready for use. By being careful several vessels may be arranged one above the other in this handy little receptacle. Air out occasionally to prevent mold and odors from collecting.

A COOLER DUMMY

Where a deep, cool well is located near the house an arrangement may be devised that will serve the purpose of a refrigerator. Construct a frame of strong boards with a groove in which a board on the side of the box of shelves can run. Attach a rope to the top of the box of shelves, pass it over a wheel on the crank shaft and balance with a counter weight.

If the frame is 16 feet long and extended down near to the surface of the water the lowest temperature may be secured. A nice looking top may be constructed for the arrangement, with a door opening into the shelves when they are drawn to the top. Most wells are almost as cool as a refrigerator, and this sort of an arrangement serves the purpose with a great deal less expense.

A wire clothesline will serve as a cable. Any old pieces of iron will do for the counter weight, and it is well to have a ratchet wheel, such as are found on old chain pumps, to prevent the elevator dropping when it is well filled. Make as many parts as possible of wood to prevent rusting. One such elevator is 42 inches high and 18 inches square.

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AN OUTDOOR CLOSET

When the housewife has baked a pie or a pudding for dinner and wishes to cool it quickly in winter it has to be set out of doors; but there the trouble begins. It cannot be set upon the snow, since that would melt and engulf the hot dish. Moreover, the cat or dog, or some neighbor's cat or dog, is likely to be lurking about the door, ready for pie. Let the handy man make a little out-of-door cupboard for the use of the housekeeper, locating it beside the kitchen door. Get an empty grocery box of the right size and hinge the cover to the top, placing a knob on the other edge. Make a support for this closet by driving two strips of wood into the ground and screwing two crosswise strips of board to the tops. Lay the grocery box on its side on these supports and nail it to them from the inside.

Here anything hot can be placed to cool quickly, and with the cover down there will be no danger from cats or dogs or hens. If desired to give a freer access to the cold air, several holes can be bored in each end and in the bottom before putting the box in position on the supports. If the ground is frozen too hard to insert the strips of board, the closet can be placed against the side of the house, close to the kitchen door, and supported in place by two wooden brackets. Another plan to secure the same result would be to make the closet and screw a wooden handle to the middle of the top, with holes bored in ends and back. When it is to be used put the dish, or dishes, inside and set the closet out onto the snow beside the door.

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HOMEMADE REFRIGERATOR

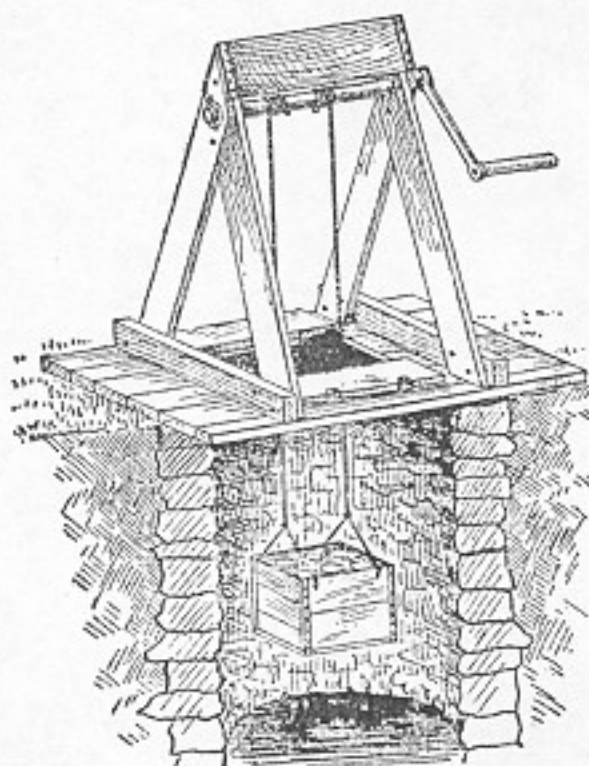
Take two large boxes, one 2 inches smaller than the other every way, and bore two 1-inch holes in the bottom of each box for drainage. Fill up 2

inches in the large box with powdered charcoal or coal ashes. Put the smaller box inside and fill the space all around with the charcoal or ashes. Fix the lids to both boxes to fit tightly. Put shelves on both sides of inner box. Leave a place in the center of the box of ice. A rack, made of lath, can be laid at the bottom for ice to rest on.

ICELESS BUTTER AND MILK COOLER

The accompanying picture shows how a well may be utilized during the warm months for cooling

butter, milk and other perishable articles. It will be found very handy as a substitute for a refrigerator when the farmer has no ice supply. Anyone can make a triangular-shaped frame for the windlass, which is placed above the well; and anyone can also put the trap doors in the platform of the well. These doors should be pro-



COLD STORAGE FOR MILK

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vided with a lock, so children cannot fall in. A pin may be placed on the handle side of the windlass to prevent the crank from turning around when the box is lowered to the desired depth.

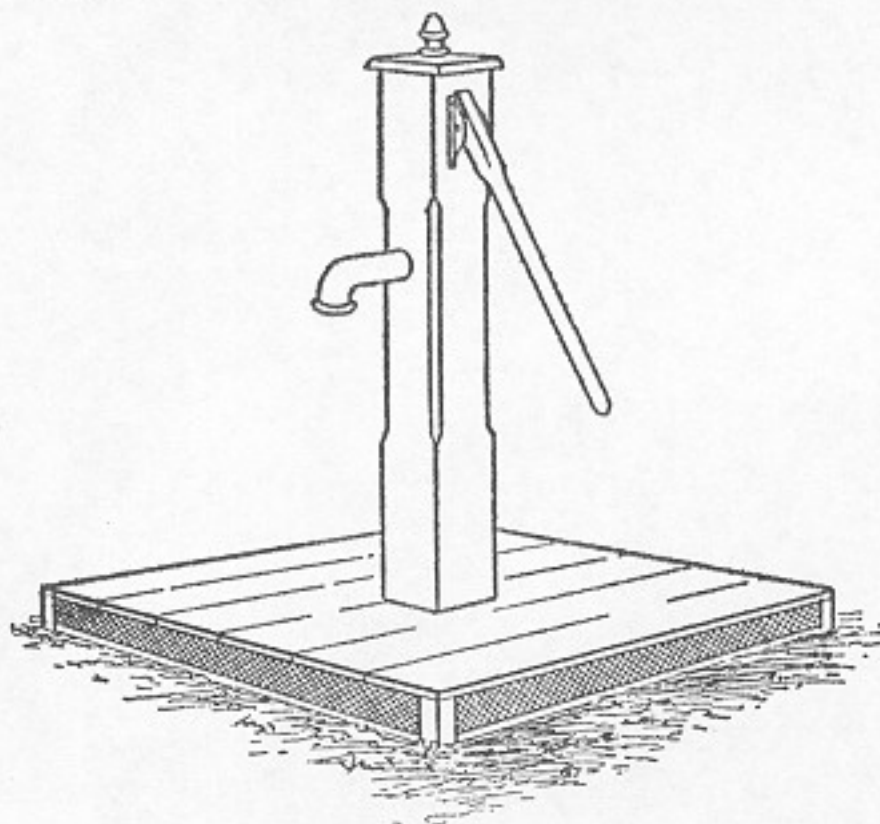
The picture is only suggestive. The shape and size of the various parts will depend upon the style of the well. Preferably, the box should be made of galvanized iron and have perforations in the bottom, so it may be lowered right into the water. Of course, this would not be feasible if the materials to be kept cold were not first placed in sealed receptacles. Where a well with a bucket pump or the ordinary wooden pump is the only available place to put such a cooler, the cooler may be at one side of the well. If necessary, the position of the pump may be shifted.

A VENTILATED PUMP PLATFORM

Here is a way to keep the well clean and pure at all times. Make the frame of the platform of 2 x 4's, allowing a space 2 to 6 inches between the top and bottom parts of the sides. This space is covered on the inside with a fly screen to keep out dirt and

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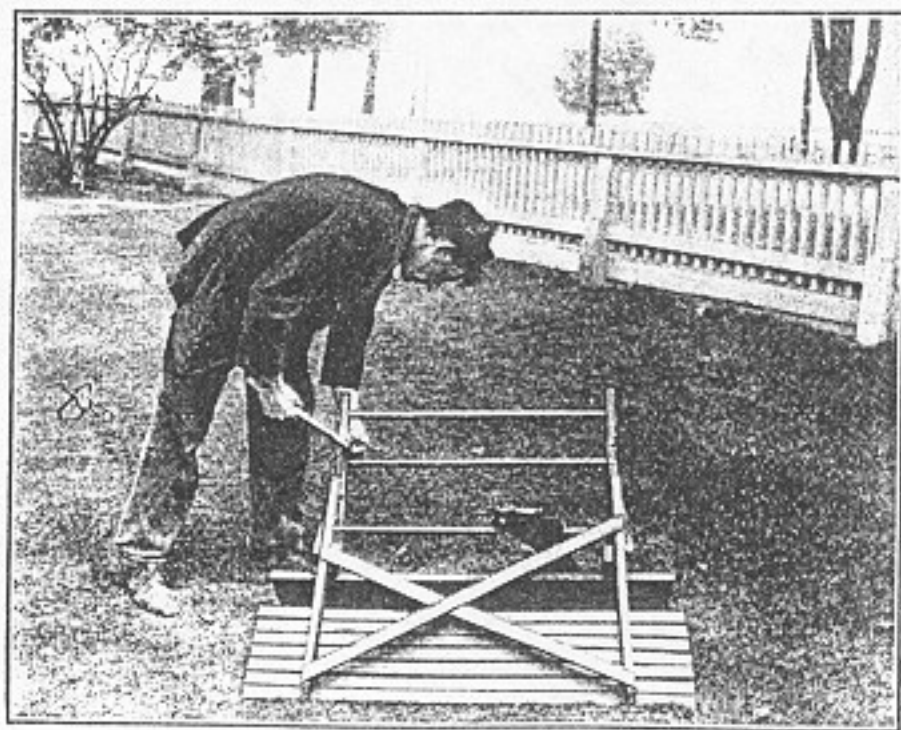
insects, and outside of this with a larger meshed screen to keep out large vermin. This gives good ventilation to the well, which never becomes foul. In the winter cover the platform with straw and snow.



HELPS TO KEEP WATER PURE

CLEANING A WELL

To remove floating litter from a well, take an ordinary sand sieve, and, after marking off the rim into three parts, attach a wire to any of the two points and to this improvised handle attach a rope. Fasten the end of the rope to the third point in the rim and a weight to the sieve, so that it can be lowered into the well and will sink. When used, sink the sieve edgewise into the water and pull the



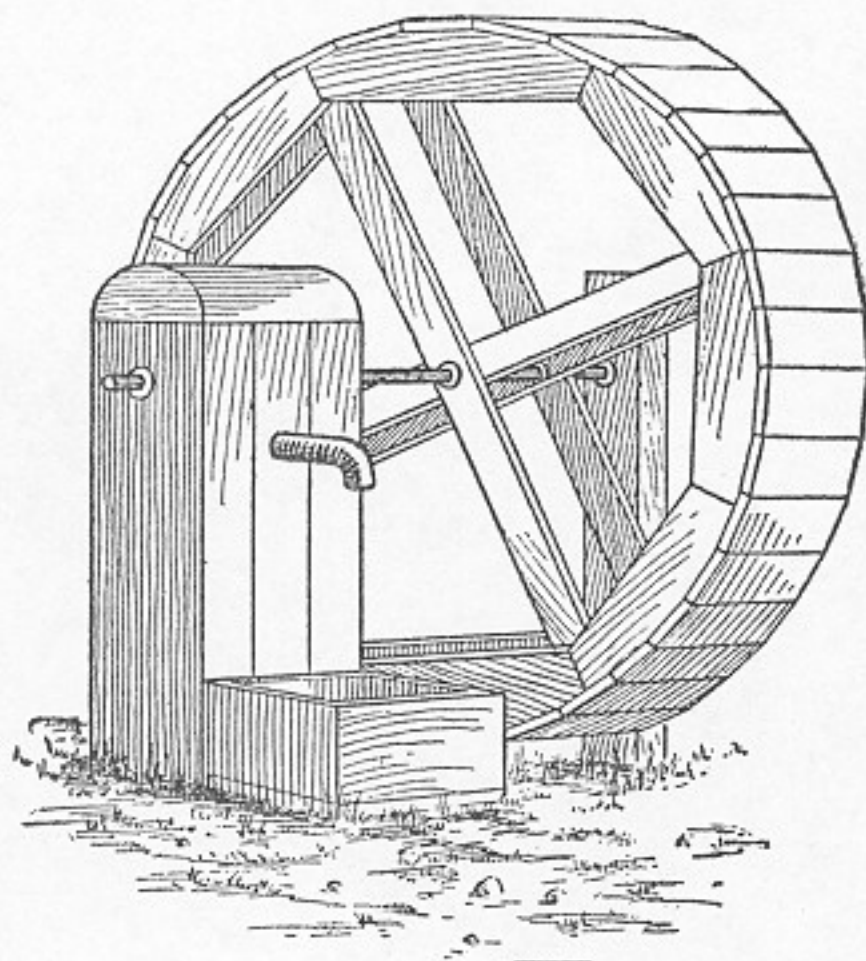
A NAIL IN TIME

67

rope with a single attachment and it may be lifted out with all the floating sticks and timber on the surface of the water.

DOG POWER FOR PUMP

This sketch shows an arrangement for making use of the dog for carrying water. It simply consists of a wheel 8 feet in diameter and 18 inches



DOG POWER PUMPING DEVICE

wide, with room enough inside for the dog to walk around, where he acts as a tread power, which causes the pump to revolve. In southern Califor-

68

nia there are a number of these dog-power pumps, which cost less than \$15. A good-sized dog can easily earn his living in an arrangement of this kind.

FILTER FOR CISTERN WATER

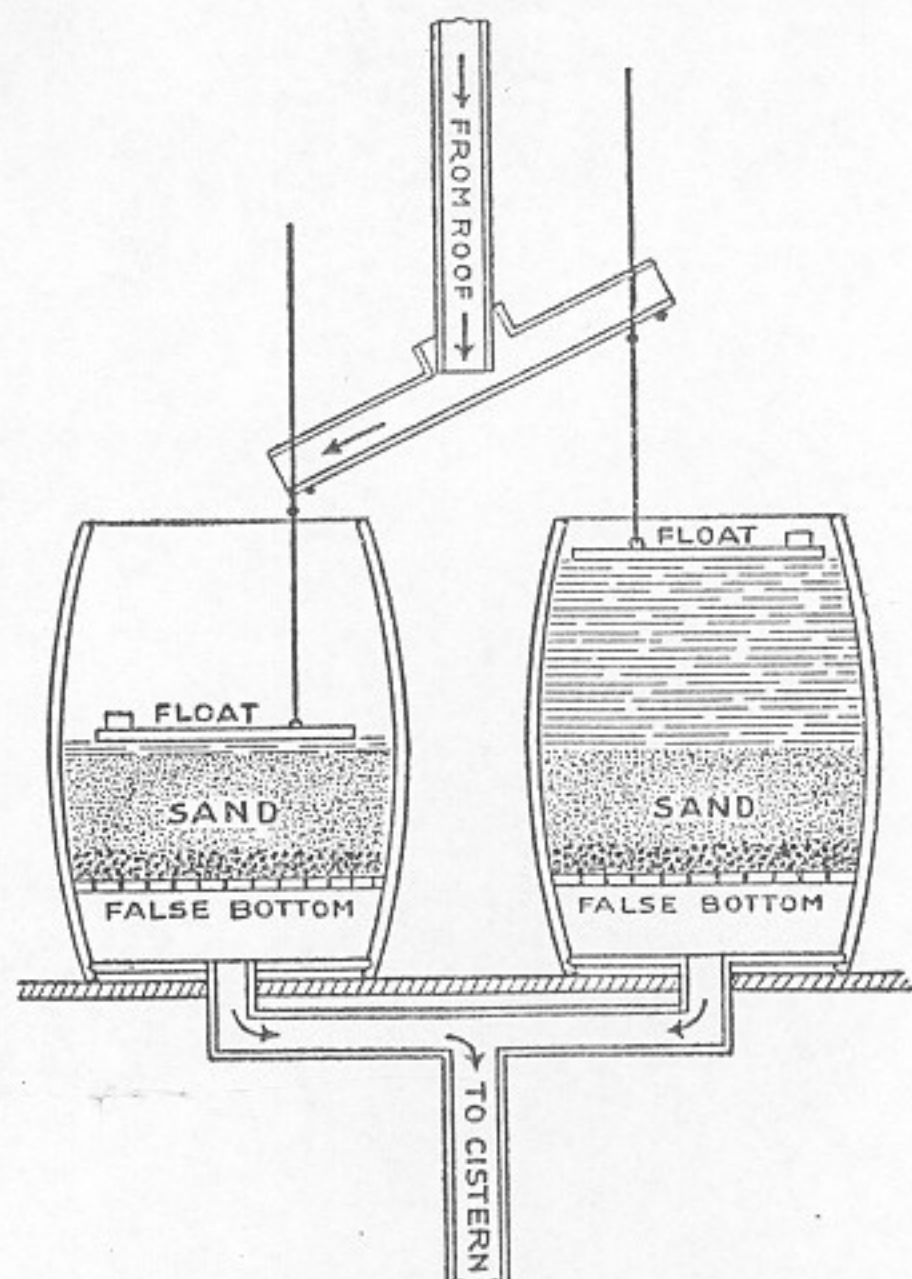
The problem of keeping water in a cistern clean is most easily solved by not allowing it to get dirty, as can be done by the device shown in the drawing on page 69. Two barrels, each with a perforated false bottom, are set side by side beneath the water spout from the roof and connected with a pipe leading to the cistern. Above the false bottoms fine gravel and then sand are packed to the depth of 8 or more inches. On top of the sand rest stout floats as large as can be let down into the

barrels. From near the margin of the floats two heavy wires extend vertically upward about 2 feet to engage loosely near their centers with a tilting spout by means of knobs on both the ends of the spout and the wires.

When the barrels are empty the floats rest on the sand. As the water begins to pour in one barrel it strikes the float, but is prevented from gouging a very deep hole at the outside of the barrel by striking a strip of wood about 1 inch high, 2 inches wide and 1 foot long. This spreads the flow. A layer of gravel at this place would also help prevent gouging. If the flow is too great to filter away readily, the float will rise and the knob on the wire will engage with the spout, which will be tilted until the flow will suddenly start into the other barrel. If the delivery pipe to the cistern be large enough there should be no danger of either barrel overflowing. When the sand becomes dirty

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a few minutes will serve to remove it and put in fresh. This will insure clean water in the cistern, and greatly reduce the number of times the disagreeable job of cleaning out the cistern must be done.



TWO-BARREL FILTER

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A HANDY WATER FILTER

Nearly every farm can boast of good water, but no water, either from well, spring or stream, is pure, as it all contains more or less animal or vegetable matter. The only way to make it pure is to filter it, just as is done in city supply reservoirs, or private filtering tanks.

A simple water filter is very easily made that answers all purposes for domestic use. The plan of its operations is identical with that employed in large reservoirs where water is filtered on a large scale for general distribution. This filter consists, primarily, of two flower pots, set one above the other. In the bottom of the upper pot is stuffed a large sponge. A sponge is also stuffed in the bottom of the lower pot, but it is more adequately supplied with filtering material by placing above the sponge a layer of smooth pebbles, then a layer of coarse sand, and still above this a layer of pounded charcoal 3 or 4 inches in depth. It is also best to place another layer of smooth pebbles above the charcoal, to prevent it from being stirred up during the circulation of the water.

The upper pot should be the largest, and if the lower one is strong, the upper one may stand in it, or two strips of wood will serve as a base support. The two pots thus arranged are placed on a three-legged stool with a hole in it, through which the water drips through the bottom of the lower pot into the mouth of a jug set underneath. The upper pot serves as a reservoir, and its sponge stops the coarser impurities, and thus the filtering layers of the lower one may be used for a year without being renewed, though it is necessary frequently to clean the sponge of the upper pot.

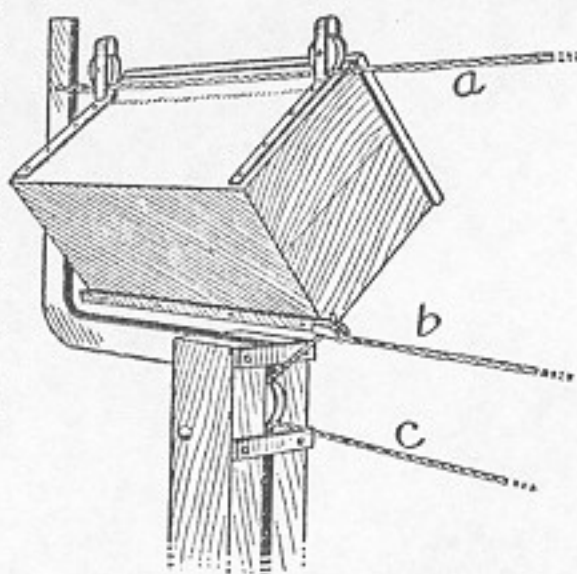
71

The layers of sand and charcoal of the lower pot are positively effective in stopping all animal and vegetable matter, as well as many smaller impurities in the water. The only trouble one may experience with it is in neglecting the upper sponge for too long a time, or in stuffing it in too loosely, thus allowing the water to pass from the upper pot faster than it can filter through the lower one. Only a little attention, once or twice a month, is sufficient to keep this simple filter in perfect running order.

DELIVERING MAIL BY TROLLEY

Where the house stands some distance back from the highway a trolley can be rigged up to save

steps in getting the mail. The box is hung on two pulley door hangers, as shown in cut. A strong post, with a bent arm, is set next the highway, *a*, suspended between it and the house, on which the box runs. A pulley is fastened in or to, the post, and over it runs a



TROLLEY MAIL BOX

cord, *b*, *c*, to pull the box back and forth between the house and the road. The box is sent down to meet the carrier, who places the mail in it, and then it is quickly pulled back to the house.

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BEAUTY IN A BARREL

A very nice ornamentation for the lawn is shown in the picture. It is made by sawing an oil barrel



HALF-BARREL PLANT HOLDER

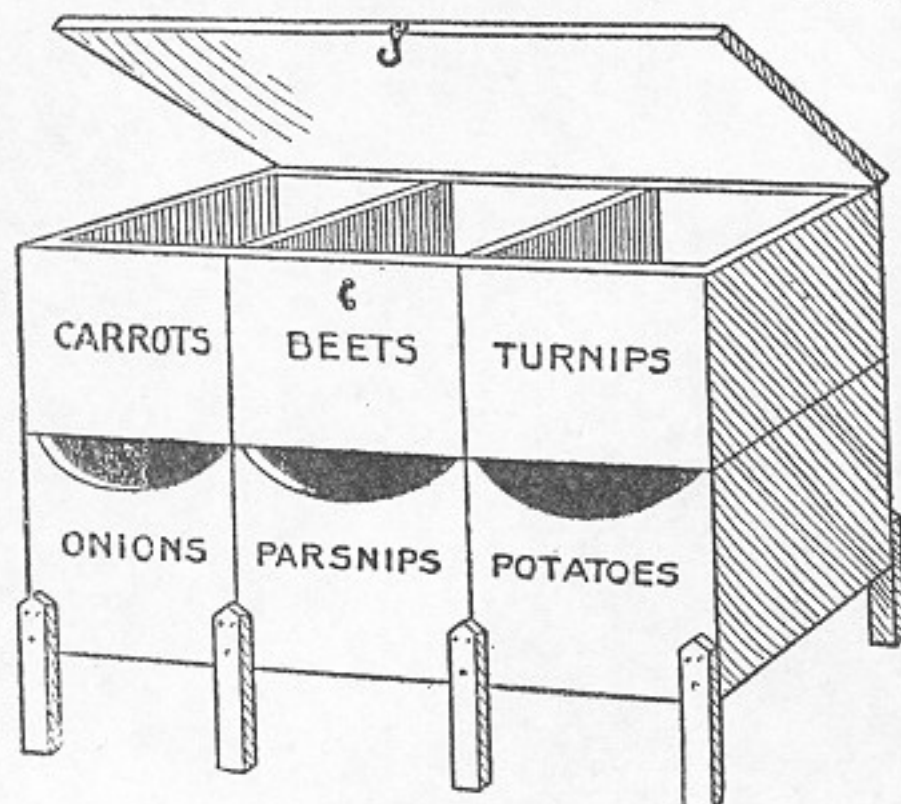
in two as shown, and mounting it on legs. Paint it and set one-half of the barrel on each side of the walk and use them for growing flowers in during the summer. Care should be taken to have the hoops thoroughly nailed to the staves and to have the heads solid. Dark green or dark red are good colors for the painting. If preferred, the barrel may rest upon the ground, but should be securely braced or blocked to prevent rolling.

STORAGE BIN FOR VEGETABLES

Instead of keeping the vegetables in barrels or boxes scattered all over the cellar, have a set of storage bins. Take six drygoods boxes and bolt them together as shown in the drawing. Put legs on them to hold them off the floor and a cover on the top. Then paint on the boxes the names of the

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vegetables. It is most convenient to have the vegetables most frequently used in the upper boxes, which would not be true of the bin shown in the picture. If the upper row of boxes is attached to each other, but not to the lower ones, the top section can easily be moved enough to make filling the lower boxes a simple matter. Otherwise, the vegetables



VEGETABLE BIN

would have to be put in through the openings at the top of each box a few at a time by hand, instead of pouring them in.

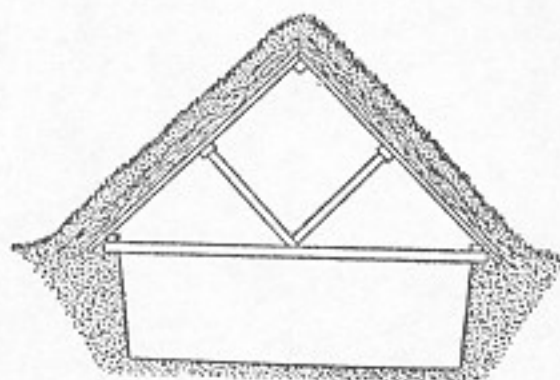
Many people would not care to keep their potatoes in such a sectional bin, preferring a large separate bin. It certainly is all right for other root vegetables, and many other products of the farm that are stored might well be kept handy for use in such a labeled sectional bin.

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AN INEXPENSIVE CELLAR

A temporary cellar is sometimes necessary in cold countries where that under the house is not

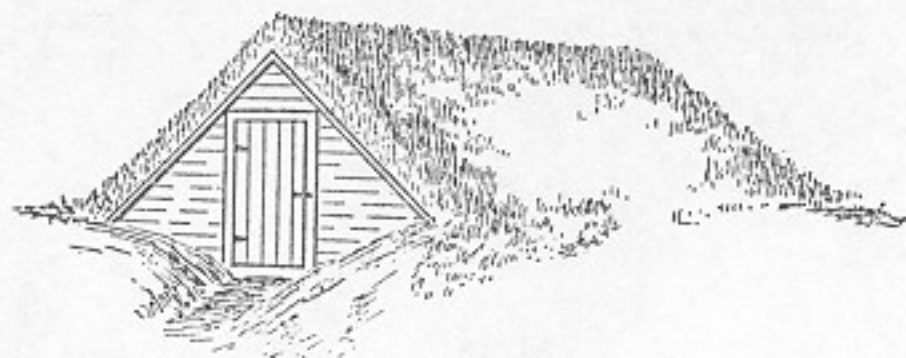
sufficient for storing vegetables. A very effective and useful temporary cellar may be constructed after the following method, as shown by the drawings: Dig a pit 15 feet long, 10 feet wide, 4 feet deep



CROSS-SECTION

in a solid, dry place where the drainage is good. Put a gable roof of 1-inch board over the hole, supported by 2 x 4-inch strips at the eaves, gable and

half way up the sides. Strengthen by crossbeams and a central support if the lumber is not first class. Over this place 8 to 10 inches of dry straw



TEMPORARY CELLAR

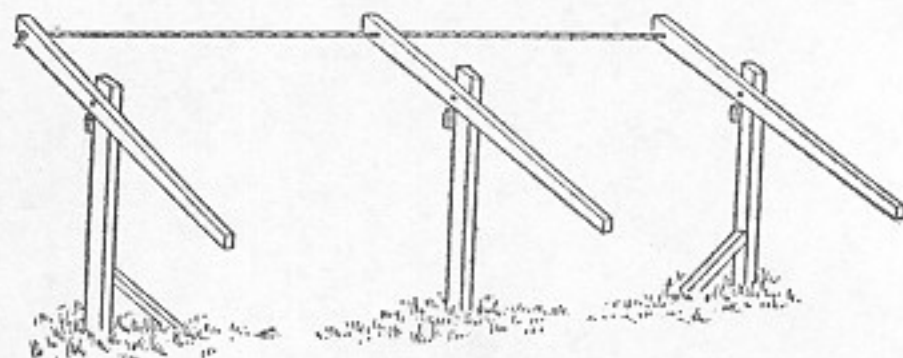
well packed and over the entire structure, excepting one end, pack earth 12 to 14 inches deep. The surface should be smooth to shed water. It is better if plastered with mud covered with sods.

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The door end must be double-walled and the space filled with straw. The door must also be double and its margin packed with cloth strips, so as to be practically airtight. If possible, the pit should be drained by a tile, the end of which is covered with a piece of wire netting to prevent the entrance of rodents. Such a cellar will prevent freezing during usual winter weather. The door should be opened on mild days and the interior aired thoroughly. The size and depth of the pit may be varied according to needs.

CLOTHESLINE UP AND DOWN

Heavy posts should be set for the ends, 3 feet in and 3 feet out of the ground. It is not necessary for the center post to be as heavy as the end ones. Have the posts clean and smooth, so they will not soil the clothes when blown against them. Take a



ELEVATED CLOTHESLINE

piece of 2 x 4-inch hard wood 5 feet long for the lever. Fasten to the post near the top with a $\frac{3}{4}$ -inch bolt, 2 feet next to the line and 3 feet for the lever. A block holds the lever in position while the clothes are being put on. A button holds the lever upright when the line is hoisted.

A CLOTHES HORSE

There is no little thing that will save the household so much as a revolving clothes horse, so near the back stoop that the clothes may be hung on it without stepping out in the snow. A solid post should have a hole bored in the top and the arms may be beveled and spiked to a piece of plank through which a bolt passes into the post, or each arm may be bored to let the bolt pass through it. Three, four or five arms may be used as desired, and of any length, provided all are of one length. No skill is required in making it, as the rope holds the arms up simply by being tight enough. It is well to set the post before measuring for the arms, so that they may be sure to reach the veranda. Some laths may be nailed together at first to make a model, if you are not sure of your ability as a carpenter.

A TOILET CLOSET

A small closet in a home, for keeping medicines and toilet articles, is a great convenience. One consists of $\frac{1}{2}$ -inch pine, 4 inches wide, planed and put together so as to be 2 x 3 feet. It has four shelves. The door is of thin pine, free from knots, planed, hinged and with a back catch. The outside of frame and door is varnished. Being in the toilet room, it is indeed a very useful as well as ornamental piece of furniture. It has no back casing or boards; simply rests against the wall. It is held in place by four short pieces of band iron, one end of each band being fastened to back of frame, the other end fastened to the wall by a screw. All

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kinds of medicines, shaving materials, soaps, wash rags, can there be kept. If there is no other looking-glass in the room, one may be fastened on the outside of door.

REVOLVING CELLAR SHELF

A handy cellar shelf that will save the housekeeper many steps may be arranged at the side of the cellar stairs, within easy reach upon descending a few steps. The shelf is contrived from an old axle and wheel. The axle is fastened to hang from the nearest beam to the stairway. The wheel is covered with thin, smoothly planed boards and the axle is kept well oiled, so the wheel will revolve readily, bringing all parts of the shelf within reach at need.

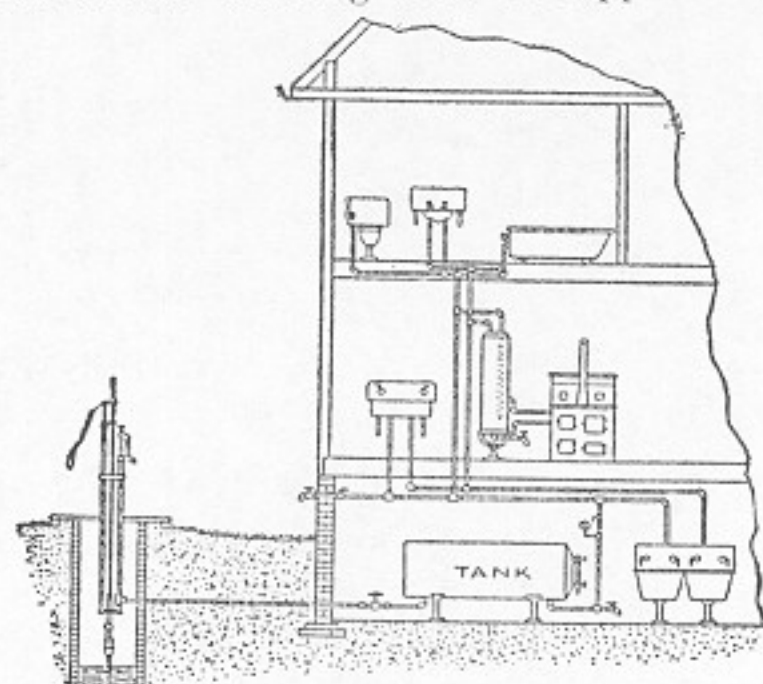
WATER SUPPLY FOR FARMHOUSE

Farmers can have running water, hot or cold, in their dwelling houses at a cost of fifty dollars and up, depending upon the size of the house and the kind of equipment needed. This makes possible the bath and toilet room, protection from fire, the easy washing of windows and walks, the sprinkling of lawns, the irrigating of gardens, and all the other conveniences which a few years ago were thought possible only in cities, where big water systems were available. This is one of the things that makes farm life attractive. It lessens the work in the house, insures a fine lawn and garden, reduces danger from fire, adds greatly to comfort and convenience in every direction.

The way to secure this is to install a water supply system, with a pressure tank in the basement.

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This pressure tank is so arranged that by pumping it full under strong air pressure the water is forced all over the house, and is available for the bathroom, toilet room and the garden or fire hose. The water is distributed about the house exactly as it is in city homes, by means of galvanized iron pipes. Where a small building is to be supplied and the



HOUSE WATER SYSTEM

amount of water to be used is not large, the system can be installed for \$50. For the average house \$90 is a better figure. Where the house is large, and where considerable amounts of water are needed for the lawn and garden, and possibly also for washing carriages, automobiles and horses, a larger system should be installed, costing up to \$150.

Installation and Operation

Its installation is easy, and its operation is exceedingly simple. Any pipe fitter or plumber can

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put in the plant so that it will work perfectly. All that is needed for operating is to keep the tank pressure up to the desired point. This may be 20, 40, 60 or 100 pounds. A few strokes of the pump, if the work is done by hand, is sufficient. If a lot of water is used, of course the amount of pumping will increase. By being economical in the use of water, that is to say, wasting none, this matter of pumping is not at all a serious problem.

The most satisfactory method of pumping, however, is to use a windmill, or what is much better, a gasoline engine. Every up-to-date farm ought to have a small gasoline engine, which can be utilized not only for operating this water supply system, but for churning, sawing wood, cutting feed and doing a dozen and one other jobs about the farm. It would take only a few minutes of pumping to raise the pressure in the tank the desired height. With the engine it will not be necessary to be economical in using water, provided the well is a good one, and the supply of water large.

Experience with Water Supply System

C. A. Shamel of Illinois, editor of the Orange Judd Farmer, has a system of this kind in his country home. It cost \$75. He put in a bathroom, a toilet, has a hot water tank in connection with the kitchen range, and no money ever expended on that farm has given anything like the amount of satisfaction and comfort as that paid for this water supply system. Arrangement is made to take care of the waste water and sewage by running a large tile from the bathroom, one-quarter of a mile distant, to a large cistern, located in the center of a big field. This is disinfected about

twice a year, and is easily handled. There is never any trouble with the water pipes, even during the coldest weather. Neither has there been any difficulty with the waste system. In fact, the water supply is practically perfect, and the people on that farm don't see how any farmer who can get together \$75 or \$100 can afford to be without it.

Up to date all the pumping has been done by hand. With the pump in perfect condition, this is not a laborious problem. On two occasions the pump valve became slightly defective through wear, and it was not convenient to fix it for a few weeks, being somewhat distant from the factory. With this condition it required a great deal more labor to do the pumping, but even with this disadvantage, it was not a serious proposition.

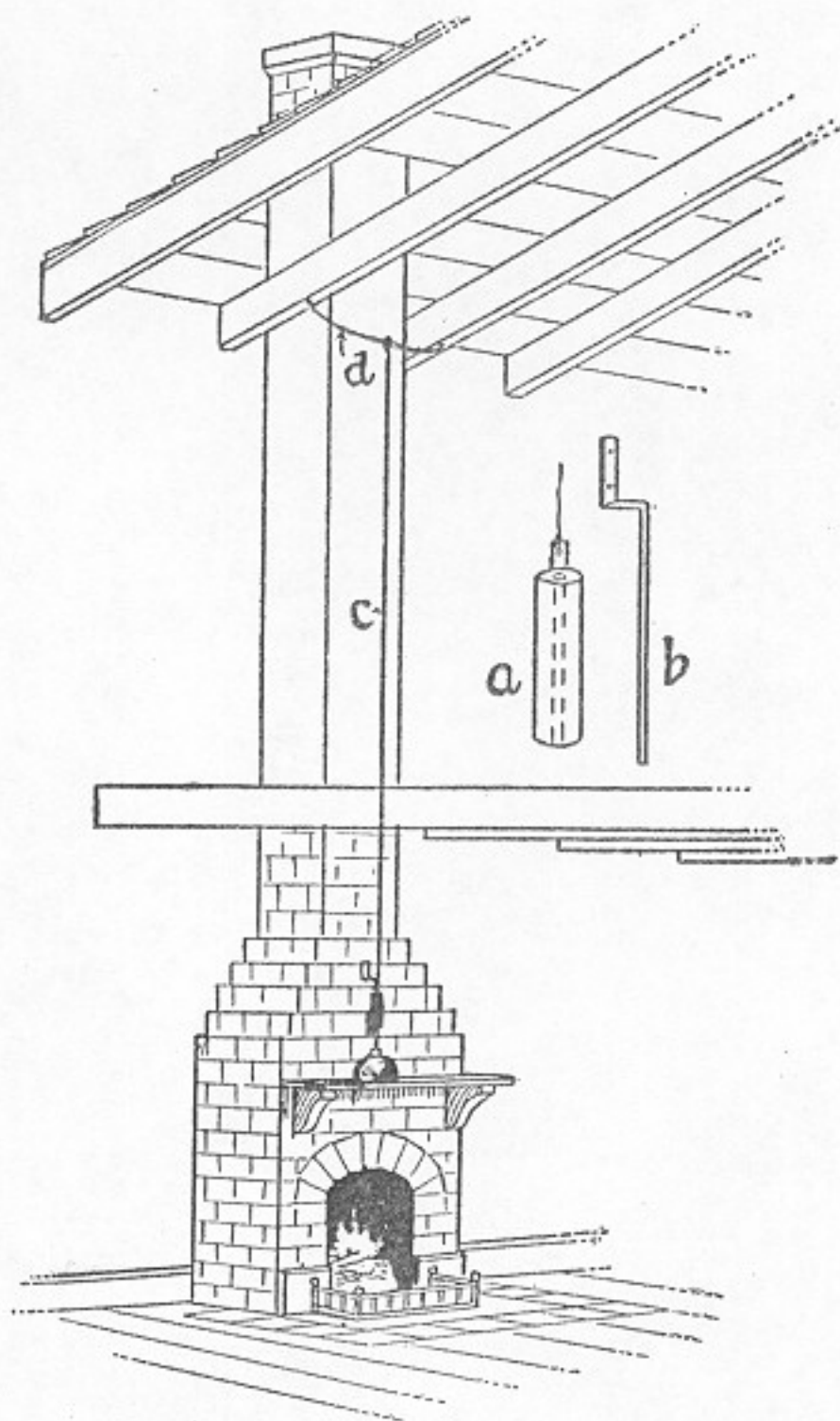
The illustration indicates the arrangement of a water supply system, and, as can be readily seen,

it is very simple. Notice the hand force pump tank in the basement to hold the water under pressure, and the arrangement of lavatories, bath and kitchen hot water service. The system can also be used for supplying water to stock tanks, and these may be located anywhere on the farm. The pressure developed in the tank is sufficient to force the water anywhere wanted. This use will, of course, depend entirely upon the wishes of the owner and is simply a matter of cost of pipes. It can very readily be used for delivering water to dairy or other stock barns, where it can be run into water troughs in the stalls, or elsewhere, as desired.

WARNING AGAINST FIRE

A handy device that will give an alarm in case the roof catches fire close to the chimney is shown

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A FIRE ALARM

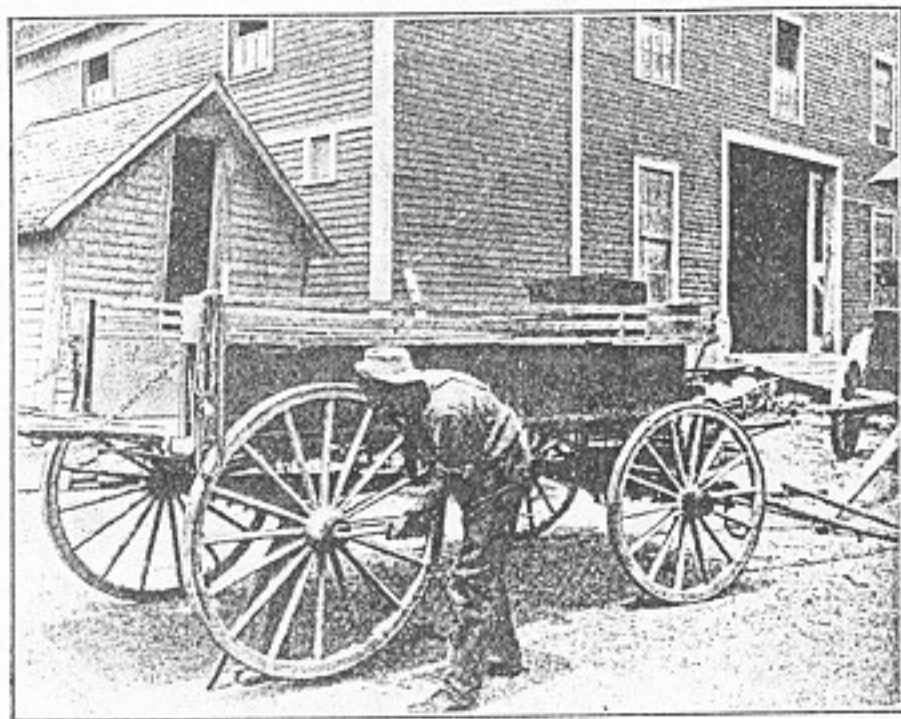
82

on the opposite page. Drive a nail in two rafters on a line with the face of the chimney, to which stretch a cord close to the chimney, so that, in case of fire, the cord will burn off and release the weight hanging to it, which in turn will drop on an electric button and ring a bell. A dry battery will cost 20 cents and a bell 50 cents. Place these on a shelf above the fireplace. Place a piece of heavy wire, *b*, 10 inches long, as shown, and fasten to the wall or chimney for the weight, *a*, to slide on. The weight need be suspended only an inch or two above the bell.

WHERE TO HANG A FIRE LADDER

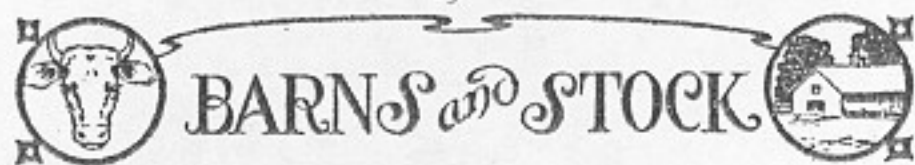
A necessity on all farms and near all farm buildings are ladders and other means of getting on the roofs, and in and out of upper story windows in time of emergency. A scuttle should be left or made in the highest part of the house roof and a ladder should be at hand that will reach the eaves of the highest roof. A good place to store a ladder of this kind is under the eaves of the L or along the rear wall of the house. Have two hooks to hang it on. Make a good ladder and keep it painted.

If your cellar is dark, there is danger of accidents when going down the stairs. Have the last step whitened so that you may easily know when you are at the bottom. You can see this step plainly even in a dim light.



TO KEEP THE WHEELS GOING AROUND

If your wagon jack isn't a good one, make a good one. You can do it yourself. Have the right kind of things to take care of the wagons easily, and use them often.

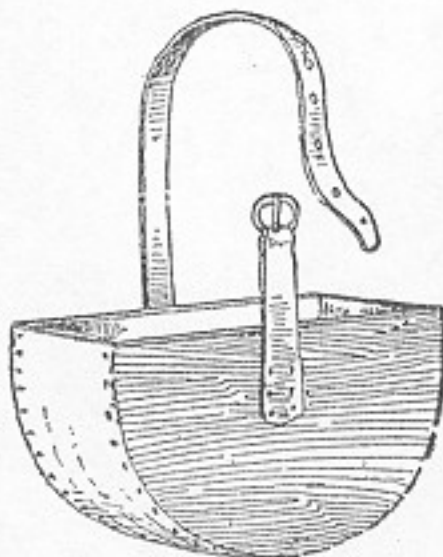


A HANDY FEED BASKET



PROVIDE a feed basket like this to strap upon the nose of a horse when giving the animal feed while away from the stable. It is simpler to make than the round basket, and has an added advantage. When

not in use, the two sides press together and occupy scarcely any room. Cut out two semi-circular pieces of wood from a $\frac{3}{4}$ -inch board in the shape suggested in the cut. Setting them at the proper distance apart, tack a strip of canvas, or other stout cloth, around the curved partition, as shown in the accompanying picture. Nail a strap and a buckle at the sides, to go over the head, and the feed basket will be complete.

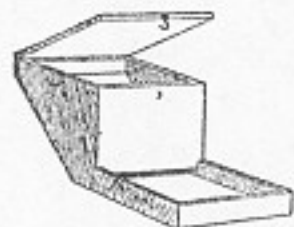


FEED BASKET

The form of this basket more nearly fits the shape of a horse's head, and besides, because of its oblong shape, gives the horse more freedom in opening his mouth than does the close-fitting round basket.

MAKE THE HORSE EAT SLOWLY

If your horse has the habit of bolting his feed you can easily remedy it by making a self-feeder on his box. The accompanying drawing shows how a feeder may be made similar to a poultry feed hopper. The contrivance may be made of inch boards large enough to hold one feed. The horse can get the grain only in small quantities and so cannot eat it more rapidly than he should. The bottom must be made with enough slant to insure all of the feed coming out in the trough.



HOLDS ONE FEED

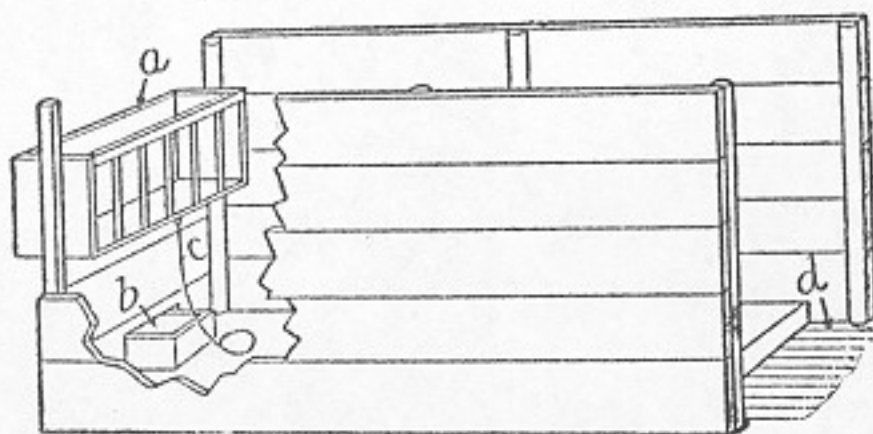
STALLS BETTER THAN STANCHIONS

The only point in favor of stanchions is that they take up less room than stalls, but the increase in milk is a reward for allowing more space and convenience to each cow. The cut shows one kind of

stall. The rack, *a*, is of hardwood 30 inches high, with the slats wide enough so the cow can thrust her nose through up to her eyes.

The bottom of the rack is 18 inches wide, extending into the stall toward the cow. The feed

box, *b*, slides through an opening in the stall on the barn floor. It can be drawn into the feedway, cleansed out and a new feed put in without being disturbed by the cow. The halter strap, *c*, is just long enough to allow the cow to lie down comfortably. The gutter, *d*, is 8 inches lower than the

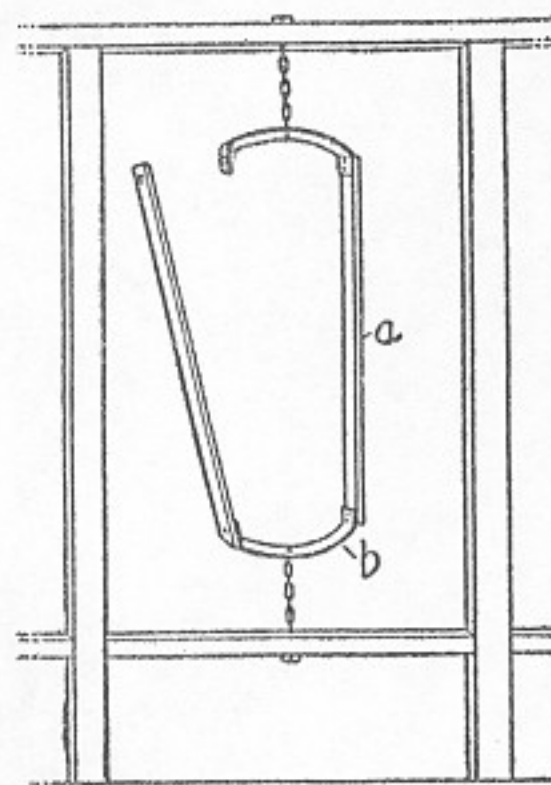


PLAN OF COW STALL

stall floor. When she lies down she will put her head under the rack in kneeling and when she gets up, she will move backward so that she can look through the rack. The length and width of stall can be made to suit the cows. Small breeds, like Jerseys and Ayrshires, will need about 6 inches less each way than Holsteins and Shorthorns.

GOOD TIES FOR COWS

The merits of stanchions and other forms of cow ties have been debated by dairymen for a long time.



SWINGING STANCHIONS

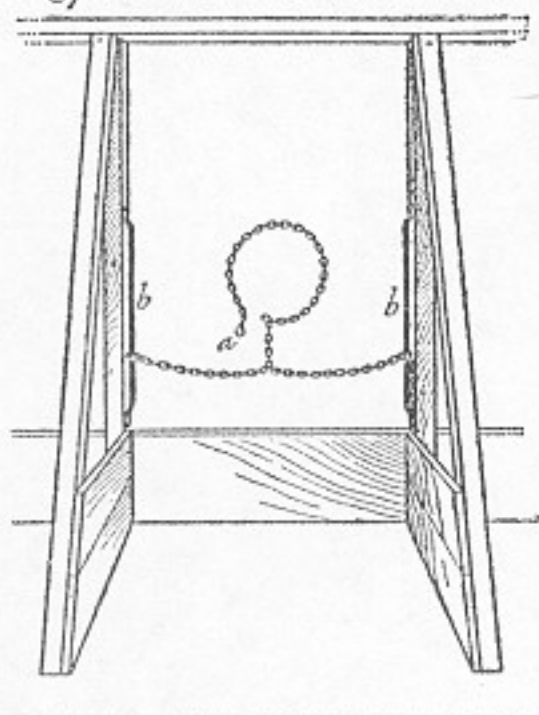
The mass of experience is in favor of the tying arrangement which will give the cow the most freedom of movement. The old-fashioned solid stanchion fails in this respect. In many cases it is difficult for the cow to lie down or get up with her head fast in one of these stanchions.

The heavy swinging stanchions have advantages over this, but it also

must be criticised in many cases, because of its weight and of the consequent lack of freedom on the part of the cow. A very light swinging stanchion is the best type of that form. It is easy to fasten, as the cows will in most cases put their heads in position as they go into the stall. There is not so much danger of the dairyman being struck by the horns of the cow in fastening these stanchions. Many modern barns are equipped with this kind.

The chain tie is favored in many sections. This consists simply of a crosschain with considerable slack, attached to a ring at each end which runs over a perpendicular iron rod about 18

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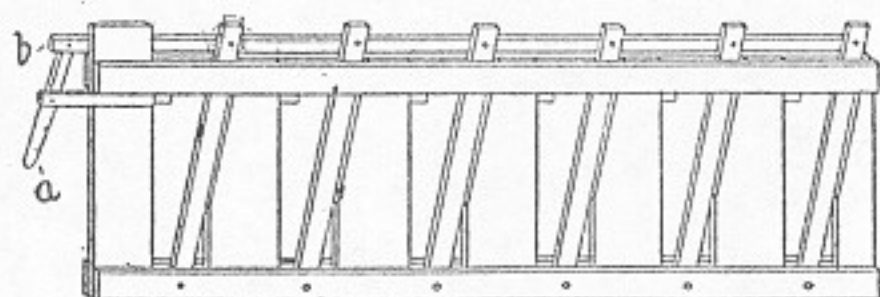


NECK CHAIN

inches long. In the center of this chain is a loop with a snap which goes around the cow's neck. This arrangement gives the greatest freedom, and allows the cow to lie down and get up without difficulty. If light partitions are used between the heads of the cows no difficulty will be experienced in their striking each other with their horns. This is by far the least expensive of cow ties, and is at the same time one of the most satisfactory.

HANDY CALF-FEEDING DEVICE

To feed a half-dozen calves at once is entirely possible if one uses the device shown here. A man



STANCHIONS FOR CALVES

who has one reports no more trouble with calves since he has used this. He rattles a couple of buckets together, the calves come running up to the fence and soon have all their heads through the stanchions, to which they are easily fastened by throwing down lever, *a*, which draws the bar, *b*, into position. Then one may feed each calf with-

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out difficulty.

Leave a 4-inch space for the calves' heads. Make the rack of 1-inch lumber and it can be moved from one pasture to another and attached to the fence or a couple of posts. It can also be used for holding ewes at lambing time.

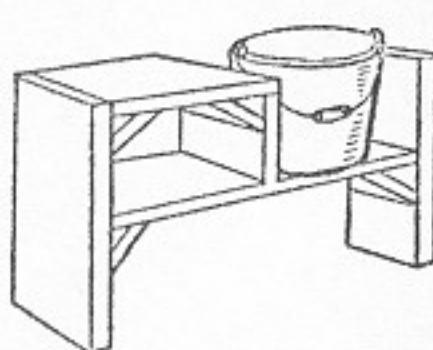
MANAGEMENT OF KICKING COWS

Make a slatted stall just high enough so the cow can't jump out, and wide enough to hold her comfortably, with nothing to spare, and narrower at the end, where her feed box should be placed as high from the ground as is comfortable for her to eat out of. This slatted stall should be long enough to have cleats through which a bar or two should be run behind the cow to keep her from backing out, and also places to run a bar in front of her hind legs about the hock joint, or as high up as possible so as not to interfere with milking. A hole about 18 or 20 inches wide is left open for this purpose from the ground up to the cow's flank, which allows easy and safe access to the udder, while the cleat and post prevent the cow from kicking outwardly at the milker, thus insuring safety.

A HANDY MILKING STOOL

Milkers who have trouble with restless cows that invariably either upset the pail or get a quantity of

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STOOL TO HOLD PAIL

dirt in it will find the stool shown here a remedy for their troubles. It is also very serviceable in fly time. The upright pieces forming the legs and ends of stools are made of 2 x 8-inch pieces about 1 foot long. The supports for the bucket and the seat are



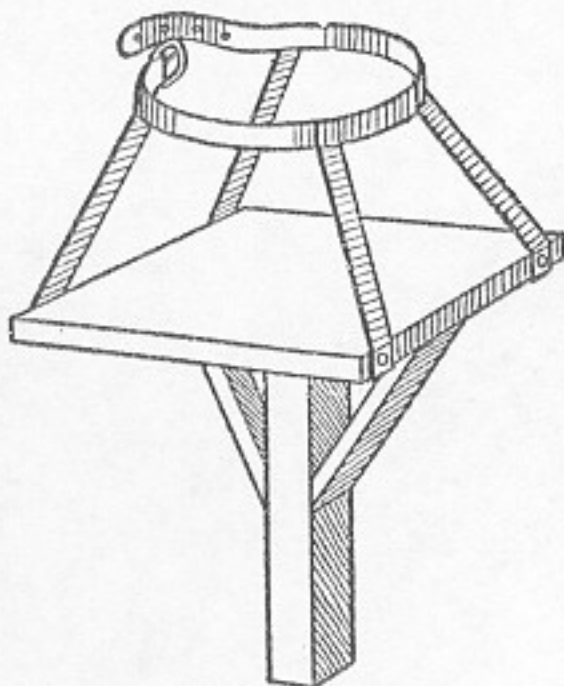
QUICK DELIVERY FROM THE FARMS

Hundreds of farmers are today making profitable use of automobiles, although their first appearance upon country roads caused only fear and anger.

made of inch boards. To secure rigidity it is well to put three-cornered blocks under the seat and bucket board as brace stays. The most restless cow is not likely to upset the bucket from this stool.

THE EVER READY STOOL

A very convenient stool for use in milking the cow in yard or field is shown in the cut. It is merely a one-legged stool to which is attached four straps connecting with a broad strap that is buckled around the waist. The stool is quickly fastened to the milker and is always in a position so one can sit down anywhere. Such a stool with a short leg would also be useful in the garden. Of course, if one pre-



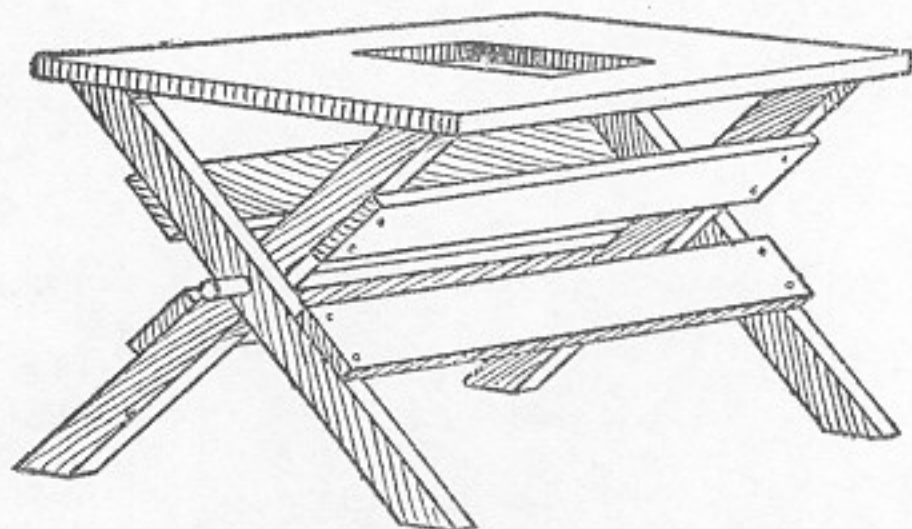
MILKING STOOL

90

ferred four legs instead of one, the stool could be so made, but experience proves that the one-legged kind serves well.

CHEAP MILKING STOOL

A cheap and very useful milking stool is made of the reel from which barbed wire has been removed. Saw off the ends so it will set level and



REEL STOOL

cut a board to fit on top. Make a hand hole through the board as shown in the illustration and the stool is ready for use.

KEEP STOOLS CLEAN

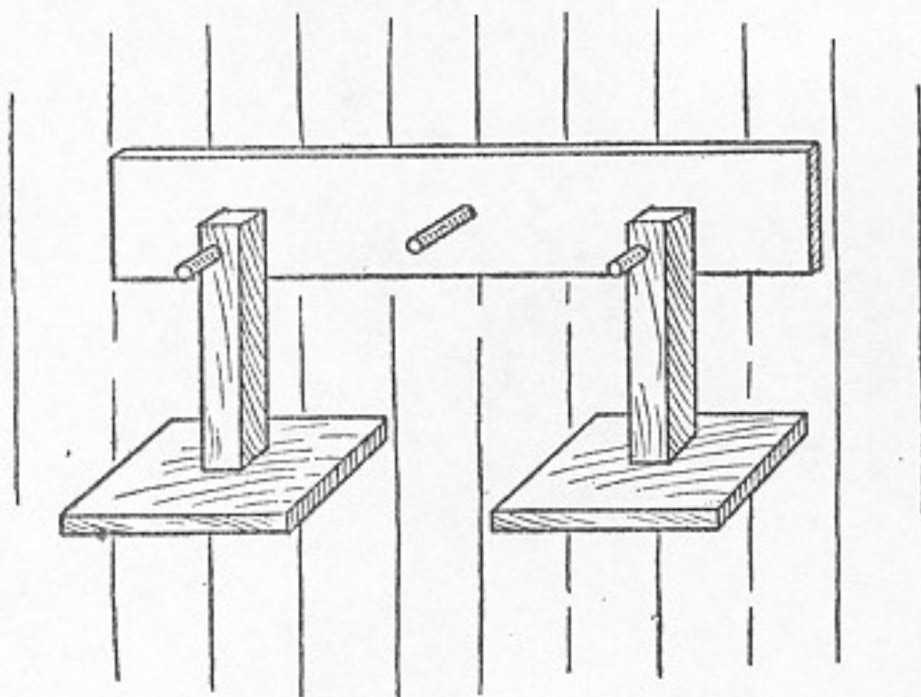
Much milk contamination is undoubtedly due to

the careless handling of the milk stools. When the milker is through milking one cow he gives the stool a toss, then he picks it up again when he starts to milk the next cow and his hands become more or less contaminated from the stool and from

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them the dirt drops into the milk pail during the milking.

When the milking is over, the stool is left in the yard or on the barn floor. It is so easy to make a small rack and to bore holes in the legs of the



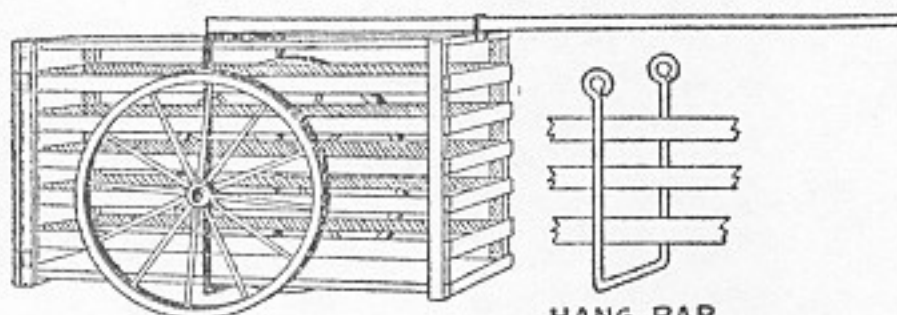
STOOL RACK

stool, so that they may be hung up. This keeps them out of the dirt and it is only necessary to brush them off carefully once in a while to keep them scrupulously clean.

A USEFUL STOCK CART

Here is a handy transfer cart, made with wheels and crossarch of an old corn plow to carry a hog or sheep, pigs or a calf. Raise the tongue, which lets the rear end on ground, then drive in the animal,

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HANG BAR

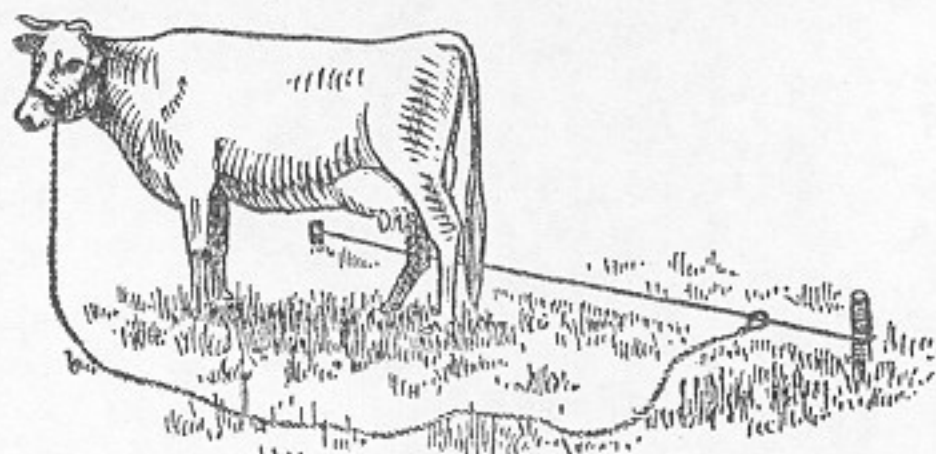
TRANSFER CART FOR SMALL ANIMALS

shut the gate, pull tongue down and you have your load ready to fasten to a wagon.

HOW TO STAKE OUT STOCK

A convenient and simple contrivance so that no

harm can come to the animal is to drive two stakes several feet apart and stretch a rope or wire on



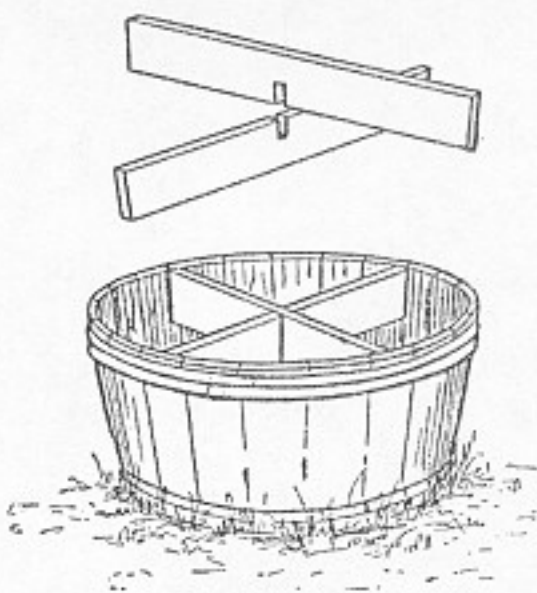
COW TIED OUT TO FEED

which a ring is placed. To this ring fasten halter strap. The animal can graze up and down on both sides without tangle or injury. The ring slides, and the stretched wire will give some.

93

FEED BOX FOR FIELD

A handy feed box for use in open lots or when steers are being fed upon grass is shown in the



TUB FEED BOX

cut. Cut a barrel in two and strengthen the halves by placing a frame of two boards across the inside, as shown in this sketch. This will prevent the tub being smashed and will allow four animals to eat out of the trough without bothering each other unnecessarily.

It is important that a very strong barrel be selected and that the hoops be nailed to each stave.

94

CHEAP SHEDS OF STRAW

It would pay every farmer to put up in the pastures some kind of protection for his sheep, hogs and cattle. Where labor is scarce and hay and straw is plentiful and cheap, a condition which prevails in many large sections, straw sheds and barns are very profitable. Put up a framework of posts 8 feet high, 16 feet wide and as long as needed; 30 feet is a good length.

The posts are hewed evenly on two sides and set so that a bale of straw will fit snugly between them. They are cut off at a uniform height and a 2 x 6 spiked securely on top. Rafters are nailed to this

and covered loosely with poles. Baled straw is used for the sides.

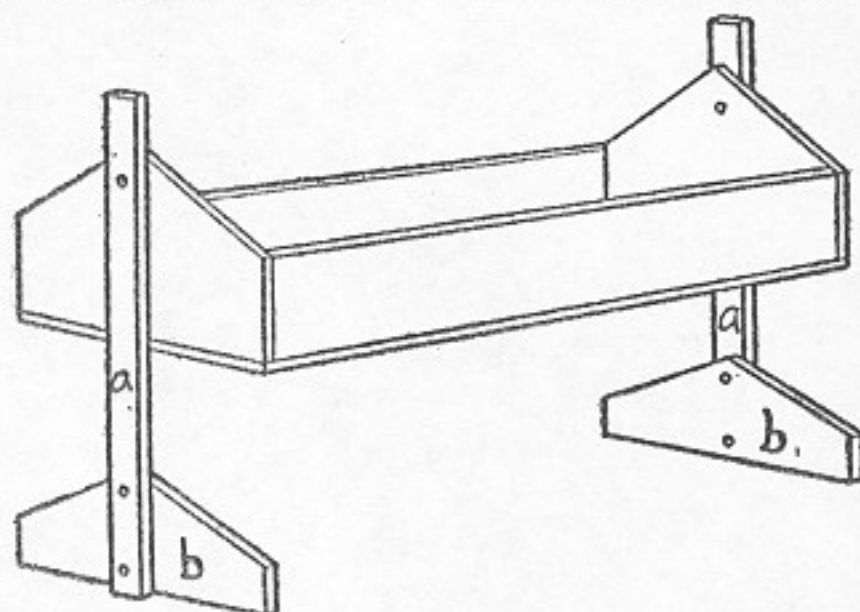
After the sides are up the roof is covered 2 feet deep with loose straw held in place with a few poles that are tied together in pairs and placed over the ridge. Several of these sheds have been built for five years and have not needed any attention.

FEED TROUGH FOR SHEEP

For a sheep trough procure two 6-inch boards, *a*, about 3 feet long and at the bottom of each fasten another board, *b*. Make a flat trough and let the

95

ends project above the top. Bore a hole through each end and also through the standards, *a*, and hang the trough on bolts. After the sheep eat and



SWINGING SHEEP TROUGH

leave the cobs, or if it rains, the trough can be turned bottom side up and quickly cleaned.



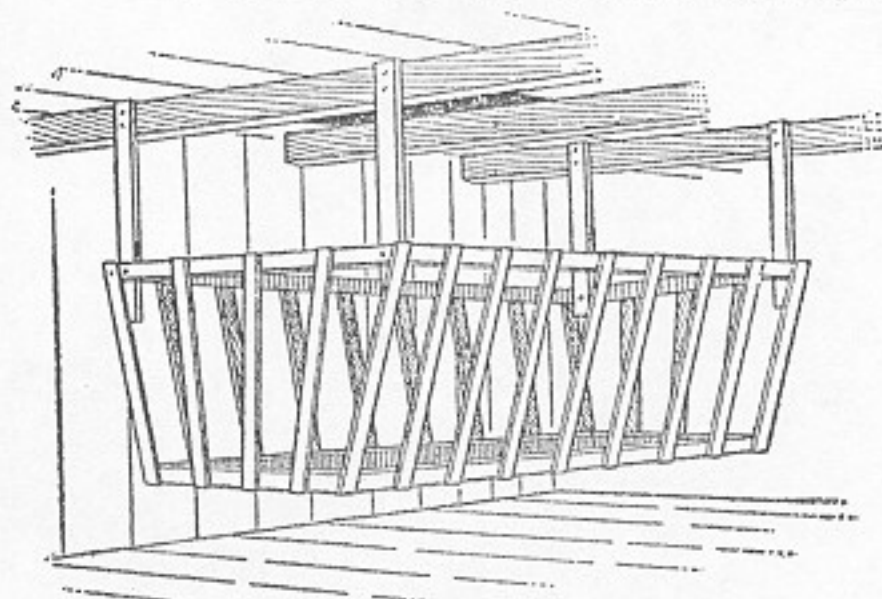
A HANDY DEVICE OF THE ORIENT

A NOVEL FEED RACK

An overhead manger, as shown in the sketch, is excellent for sheep or calves. It should hang just high enough so that they will pass under with-

96

out rubbing their backs. When filled with hay from above they will eat of it at their pleasure, and at the same time it will not take up floor space.

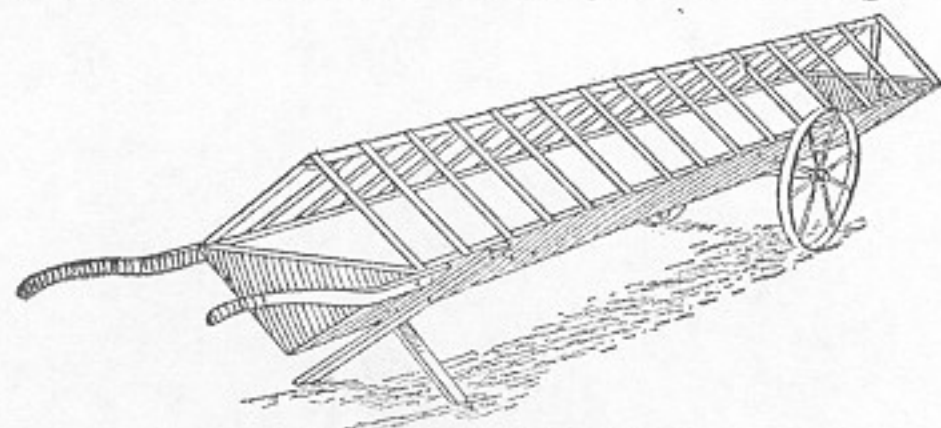


HANGING RACK

Such a manger is not suitable for grains or fine cut fodders, as too much may be wasted.

A WHEELBARROW SHEEP TROUGH

It very often happens that one wishes to run the sheep on several different pastures during the



PORTABLE RACK FEEDER

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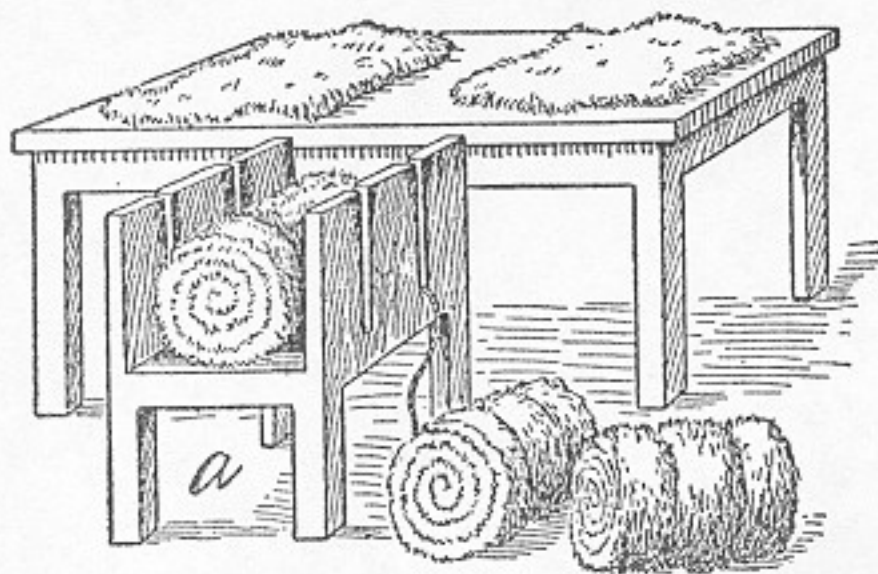
season. If heavy feed racks are used it is quite a task to move them. The drawing shows a rack that can be easily moved from one field to another by one person. It is simply mounted upon a pair of wheels and has handles on the other end.

If the rack is made very large, it can be easily attached to a wagon, and thus drawn from place to place. The one shown is mounted on old cultivator wheels.

PACKING THE FLEECE

One of the best ways to pack a fleece is to lay it

upon a table, turn in the head and tail, then the



FLEECE TYING BOX

flanks. After this roll it up into a neat roll and tie firmly, using such a device as here illustrated.

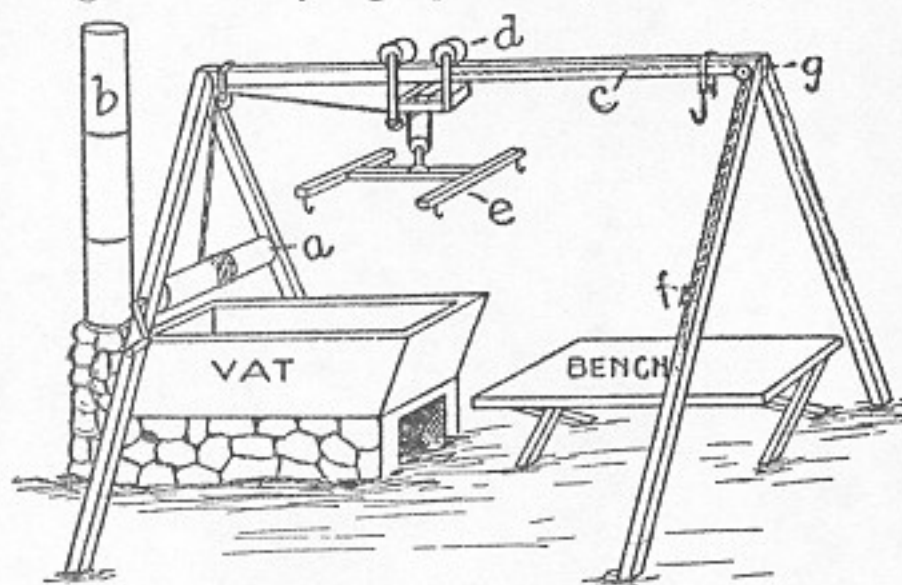
The tying box is made from light lumber with slots, as shown, through which the rope is passed. The fleece is placed upon this rope and the roll easily tied. Wool buyers prefer to have the fleece

98

loose, light to handle and elastic and tied up so that it can be opened if needed.

EASY TO HANDLE HEAVY HOGS

The old fashion of having a lot of help around at hog-killing time is going out, owing to the use of better appliances for handling the animals after killing. You may rig up a simple arrangement so



ONE-MAN BUTCHERING RIG

that you can handle heavy hogs without assistance. Build a fire box with a flue, *b*, of three joints of old stovepipe. The vat is made of heavy galvanized iron 4 feet long by 2 feet wide and 18 inches deep.

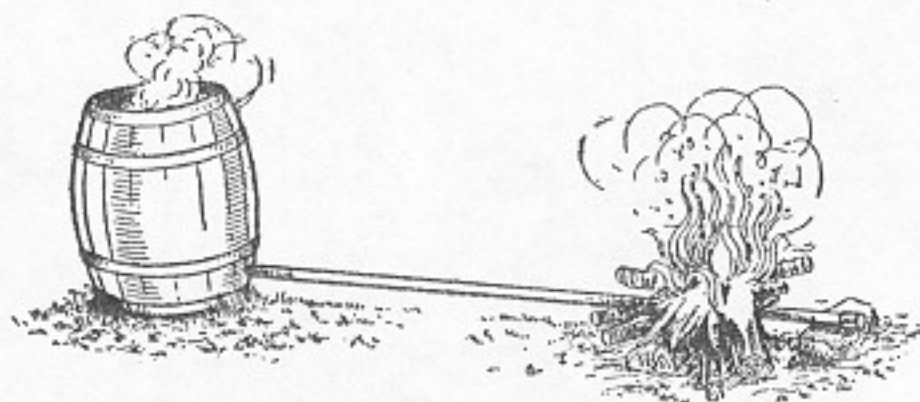
Over this erect a frame of 2 x 4-inch strips, upon which place an old traveler from a hay carrier, or construct one similar to *d*. With the windlass ar-

rangement, *a*, and the tackle, *e*, to which are attached the four feet of the hog, you can convey it from the vat to the bench. A rope, *c*, passing over the pulley at *g*, serves to pull the carrier, *d*, over the bench from the vat.

99

HEATING WATER FOR HOG KILLING

A device which is superior to the old iron kettle for heating water is shown in this sketch. Take a piece of 2-inch iron pipe 8 feet long and have it securely screwed into the bottom of a stout vinegar barrel. In the other end of the pipe screw a large wooden block.



SIMPLE WATER BOILER

By arranging the affair as shown in the sketch water in the barrel will be heated rapidly and can be removed as desired without bothering the fire. Do not make the mistake of putting a metal cap on the end of the pipe, or the steam may sometimes burst the piping before the cap will come off. The wooden block acts as a safety valve and will fly out if pressure is too great.

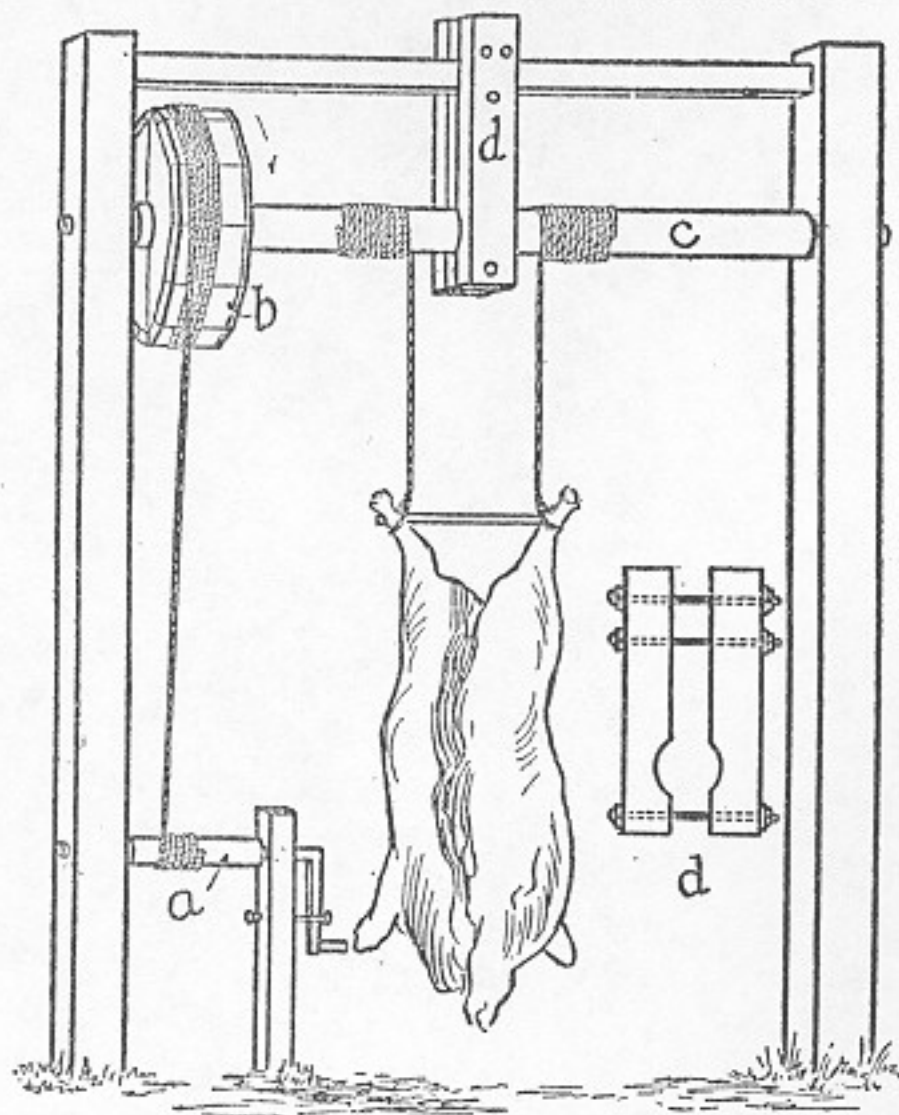
A FARM SLAUGHTERHOUSE

If one butchers his own stock on the farm he would do well to fix up a small building for a slaughterhouse. This can be done so easily and at such small expense that almost any farmer can afford one. It is generally most convenient to have

100

it near the hog yard, for then the refuse can be easily conveyed to the hogs. Indeed it would not be a half bad idea to have it in some instances a part of the hog house. The room in which to kill cattle and hogs should not be less than 15 feet square. This will give plenty of space for the work. As much of the room should be kept clear from fixtures as possible.

The floor should be made of concrete graded so that it will all drain to a central opening. A pipe should carry the liquid from this opening to a trough in the hog yard. The ideal way would be



CARCASS DERRICK

101

to make the walls of concrete for about 3 feet from the ground. This will make it much easier to keep the place clean. It is quite necessary that a good supply of water be close at hand. If possible, a water pipe with hose attached should be in the house. This will enable one to flood the floor at any time.

On page 99 is a picture of a very good device for handling the carcasses. It is made of a heavy roller, *c*, 5 to 6 inches thick, and long enough to reach across the width of the room. It is supported in the middle by a bracket, *d*, detail of which is shown in the drawing. This makes it possible to lift a carcass of any weight. A drum, *b*, is attached to the roller at one end, over which is run the rope that communicates with the crank, *a*, at the floor. Any man handy with tools can make this derrick.

In order to simplify matters one may use a barrel cart water heater. This barrel has a valve attached at the bottom. To this is fastened a rubber hose that communicates with a small coil of pipes. This coil of pipes in turn communicates with the top of the barrel by another rubber hose. The coil of pipes is placed over a fire built in a hole in the ground, and the valve is opened.

As soon as the water in the coils becomes hot it

is forced through the rubber hose, and a circulation is started. This device will heat water very rapidly and easily. When the water is heated the rubber hose is detached and the barrel wheeled under the

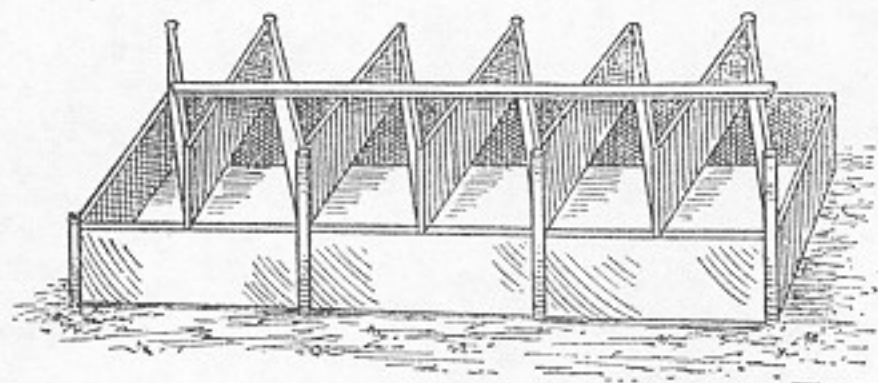
102

derrick on which the hog is hung. By means of a crank the carcass is let into the water to be scalded.

With simple devices one man can very easily do the butchering alone. It will be found convenient to have a table that folds up against the side of the building on which to cut up the meat.

KEEP PIGS OUT OF FEED TROUGH

To prevent hogs crowding and getting in the trough with their feet the accompanying plan will be found practical. You can nail the Vs, or rick-



PARTITIONED HOG TROUGH

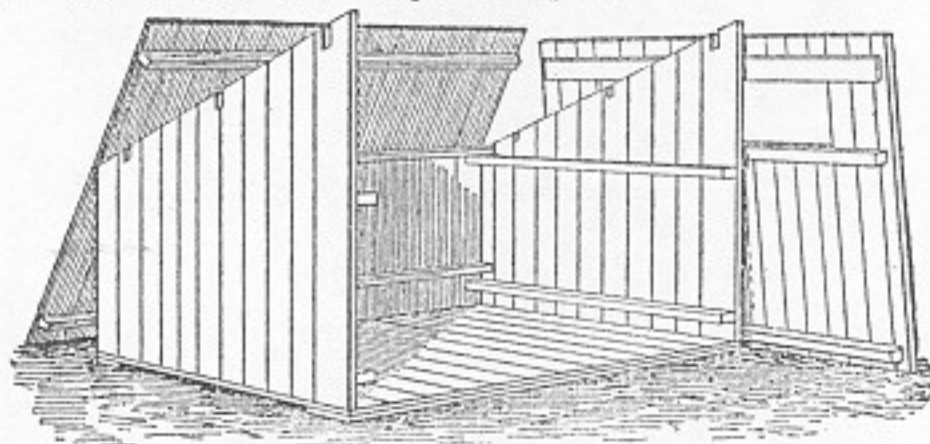
rack work, on any shaped trough. They fit on a pointed or flat-bottomed trough equally well. Nail a strip lengthwise along the top of the Vs to strengthen them. Stakes driven at intervals and nailed securely to the angles will hold the Vs and trough both solid.

MOVABLE HOUSE FOR BREEDING SOWS

Individual hog houses may be constructed with four upright walls and a shed roof, as shown below. The walls and the roof are separate and can be easily taken down and replaced. These small

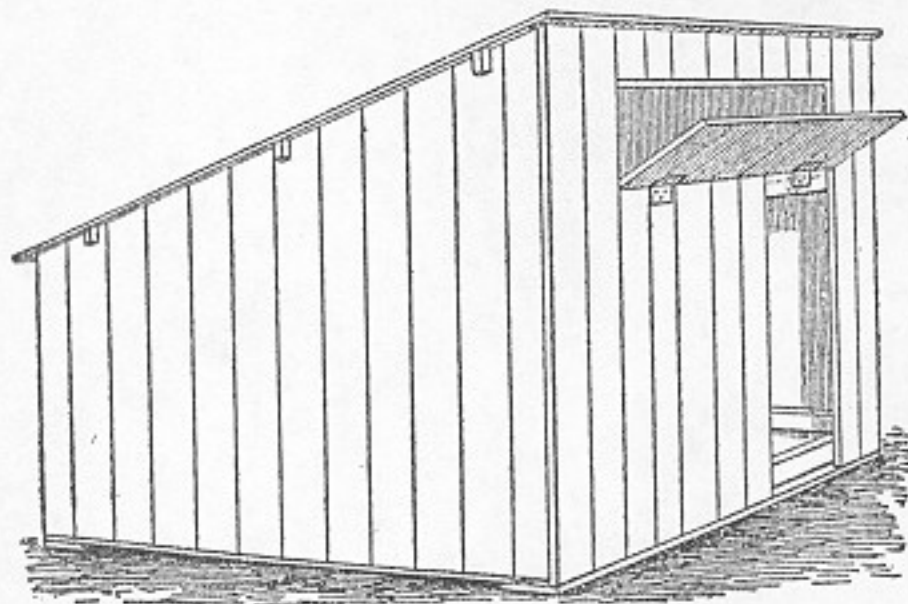
103

houses can be moved about very easily. The size of the house will depend upon conditions. The



CONSTRUCTION OF THE HOUSE

construction is shown, so that any farmer with tools can easily put up one of these houses. With the individual houses the sow at farrowing time may be kept alone and away from all disturbance and there will not be too large a number of pigs in a



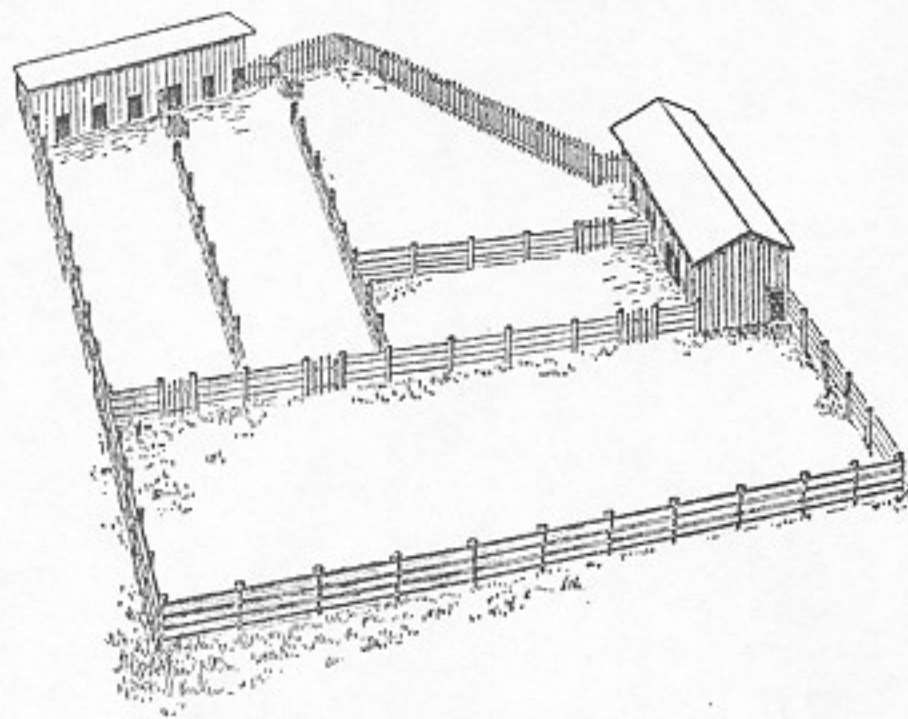
THE HOUSE SET UP

104

small lot if kept in this way. The danger of spreading diseases among the animals is also reduced to a minimum where swine are kept more isolated. When properly bedded and cared for no disastrous disease need be feared. Much depends upon the sanitary conditions.

WELL-ARRANGED HOG LOTS

An Indiana farmer keeps his pigs in long houses which are divided into compartments opening into small lots. The sketch shows how they stand. Breeding hogs and fattening shotes are allowed the run of their own lots, as well as occasional



PIG HOUSES AND PENS

changes into the larger field, shown at the bottom of the sketch, which is a timothy and clover pasture. It is better to have pigs in separate quarters

in small bunches, for in this way they can be better attended to and the growths are more uniform.

105

HANDY PIG CATCHER

Here is a homemade device for catching small pigs which saves much time and annoyance. The net may be made from a discarded lawn tennis net, the rim from a bicycle wheel, and the handle is a heavy rake handle. The net is securely fastened to the rim with some copper wire, while the rim is fastened to the handle with two pieces of band iron. Small pigs caught in the net will not squeal and struggle as when chased around the pen and caught by one leg. The element of excitement is greatly reduced by use of the net, and some would find less fun in the net method. On the whole, however, we recommend it.

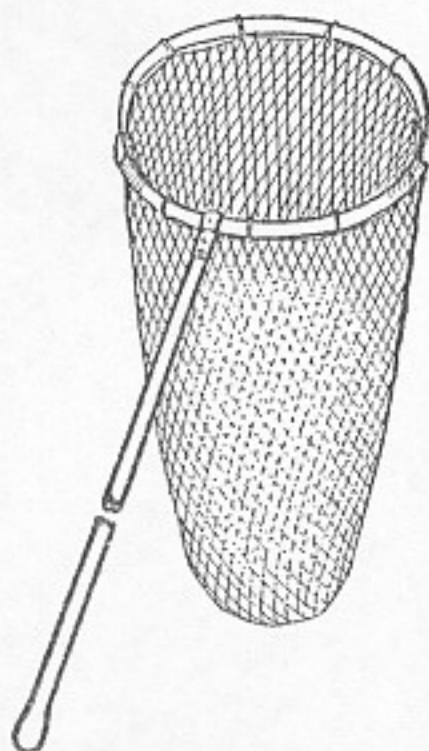
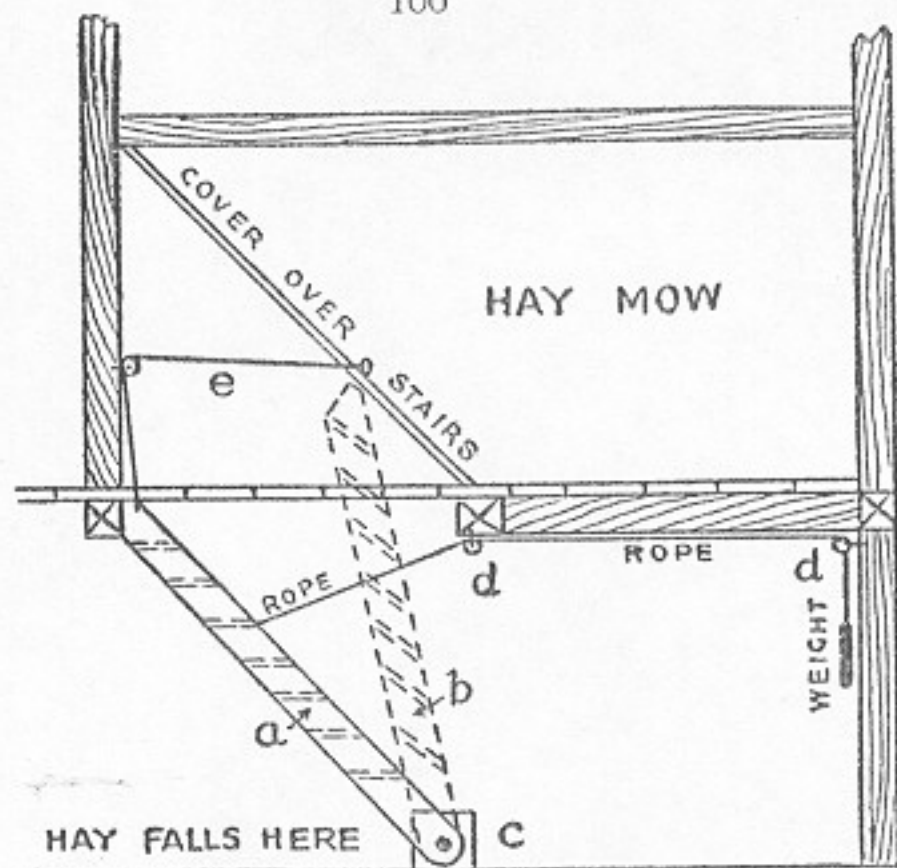


FIG NET

STAIRS FOR THE BARN

A lot of time is saved if one has handy stairs which can be used for throwing down hay as well as a passageway. These steps are made of light

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CROSS-SECTION WITH STAIRS

material and instead of putting on a lower step, use a block, c, and attach the stringers of the stairs to it

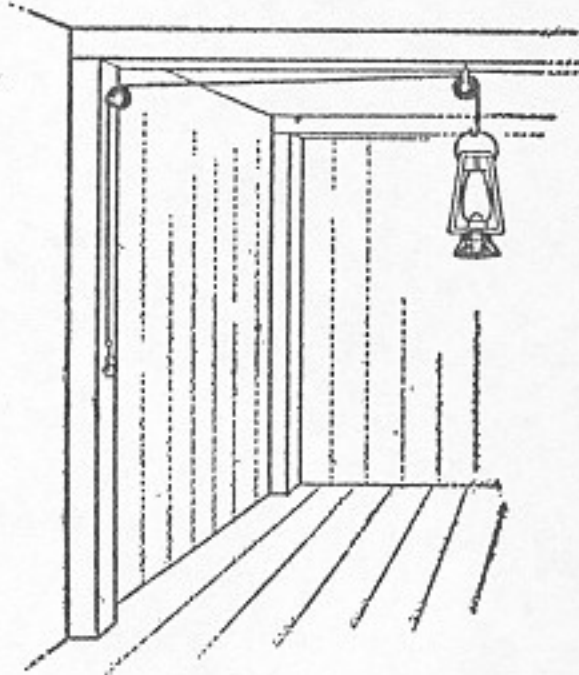
at each end with a pin. A rope passes over the pulleys at d, to a weight, which allows the stairway to be held upright while the hay is being put down. The rope, e, is handy to pull the stairs into position.

HANG UP THE LANTERN

Here is a good idea for hanging a lantern over the barn floor. Get two pulleys with screw stems, and screw on in beam over head, the other at top of post. Have a bracket lower on the same post. Take a piece of small but strong cord, and at

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one end fasten a snap and pass the other end through the pulleys. Put your lantern on the snap and draw it high enough so it will be out of reach of forking hay, and you can see all over the barn floor. You can raise the lantern high enough to pitch hay from the top of the mow with no danger of turning the light over and burning the building and contents.



PULLEY-HUNG LANTERN

The end of the cord opposite the lantern may be fastened with a snap, or more length may be allowed for adjusting the height of the lantern, and the cord may be secured by a hitch or a few turns around a button or two spikes driven halfway in and bent over in opposite directions.

ARRANGEMENT FOR WEIGHING

A homemade balance may be constructed with a joist loosely attached, so as to just balance over the rounded top of a heavy block. It will be useful in weighing hay and other bulky substances for feeding purposes. For weights, use small wooden boxes or bags of stone and sand which have been weighed on other scales. Place the required weight upon the balance and then place feed on the other

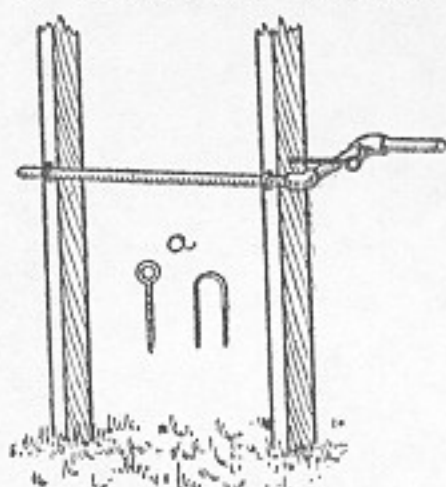
108

end until it balances the weight, and it will be accurate enough for all ordinary purposes.

A BARN WINDLASS

It is easily made of iron pipe or a bar fastened

to the ladder or other suitable support by means of eyebolts or stout staples, as shown at *a* in the drawing. It may be used for raising grain, wagon boxes and other heavy things to the upper part of the barn, and, if desired, may be rigged with block and falls, so as to increase the power without increasing the effort. A loose bolt placed in a hole will prevent unwinding. The picture shows how simple this device is. Every farmer knows how useful a barn windlass may be.



WINDLASS

The picture shows how simple this device is. Every farmer knows how useful a barn windlass may be.

GRAIN BOX EASY TO EMPTY

The trouble with most grain boxes is to get out the last third of the grain. Bending over the edge jackknife fashion is neither pleasant nor healthful. A box or bin may be made with half its front on hinges, so that it can be let down and all the contents scooped out without difficulty. The bin may be made from a piano box with a partition in the middle for two kinds of grain.

109

EASILY CONSTRUCTED GRAIN BINS

Grain bins with compartments for different kinds of feed are handy in barn or stable. By procuring a number of dry-goods boxes, all of the same size and shape, and nailing them together side by side, so that they will appear as one, the bin is easily made. The cover should extend the entire length of the bin, and though leather hinges will answer, it is better to attach it with iron ones, for then, with a good staple and hasp, the contents can be kept under lock and key if desired.

A CONVENIENT BARN TRUCK

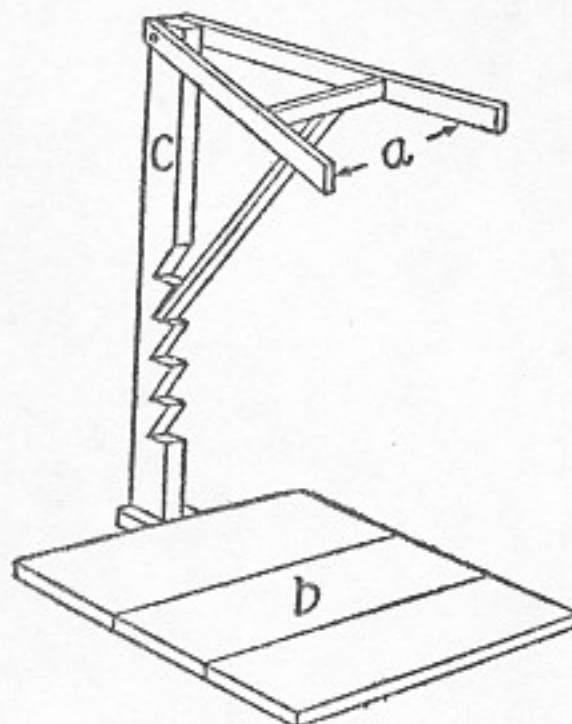
No dairyman can afford to ignore that which will lighten his labor in any way whatever. Be his stable ever so conveniently constructed, he has enough to do. Hence the importance of his considering a feeding truck or car if he does not have one. Made of good lumber, the only iron about it need be the handle at each end, by which to push or pull it along the feeding alley in front of the cows which are to be fed, and the small trucks on which it is mounted. The wheels procured, any good blacksmith can make these, so that the truck is by no means difficult to construct. The box body should be about 2 feet wide, 20 inches deep and

4½ feet long. Silage can be conveyed in it from the silo to the mangers very readily. If the silo is some distance away, it will save much hard work.

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TAKES A MAN'S PLACE

In most cases it takes two men to fill a sack of grain, but by using the sack holder



SACK HOLDER

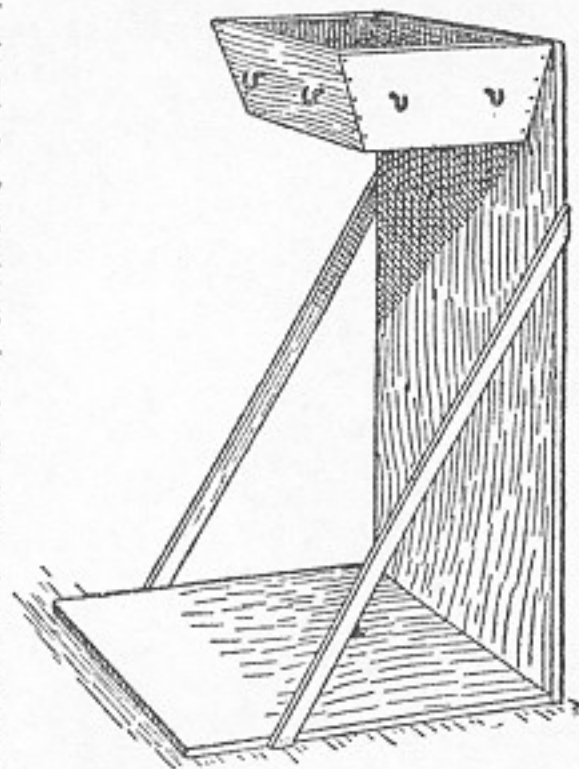
one man can do it alone. Make a platform, *b*, 20 inches square, and fasten to it a 2 x 4, *c*, with notches cut in. The arms, *a*, should be 18 inches long. Make the upright piece 3 feet long so that long bags can be handled. Some bags will require a still longer upright piece. A device that takes the place of a

man or enables a man to work twice as fast as he could without it is worth while.

111

A HANDY BAG HOLDER

It is constructed with two good boards 1 inch thick and 15 inches wide. The perpendicular one is 3½ feet long, and the horizontal one 2 feet long. These are joined together and braced as shown in the drawing, and the hopper is attached, wedged out from the perpendicular board so the bag may wrap it all the way round. The hooks for holding the bag in place can be secured at a hardware store. As the whole affair, if composed of thoroughly seasoned lumber is light to handle, it can easily be carried to any spot where grain is to be put up.



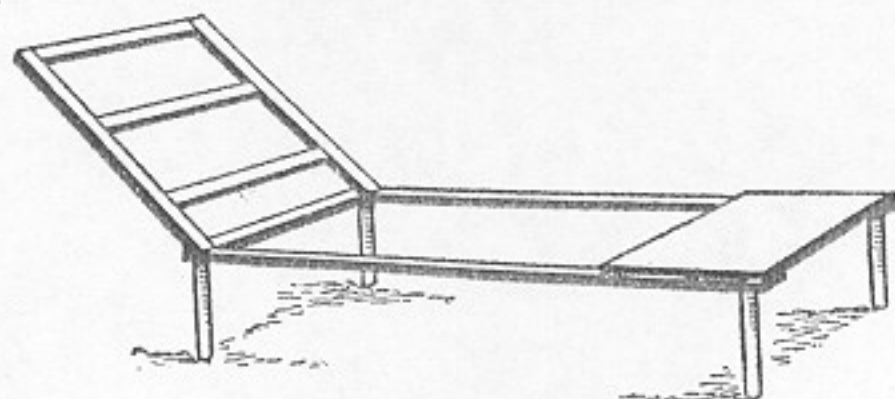
BAG HOLDER

Here is another scheme that saves time and labor and makes it possible for one man to do the work that usually requires two. This one is as good and perhaps better than any device that has been invented in the bag-holder line. In making it, an important point is to attach all parts very securely where they come together, especially the hopper and the braces. Otherwise, with hard usage the holder will get loose and break down.

112

A CORN HUSKING RACK

Many who husk their corn by hand find it very tiresome to sit on the floor or ground in a cramped position. A rack made as shown in the drawing

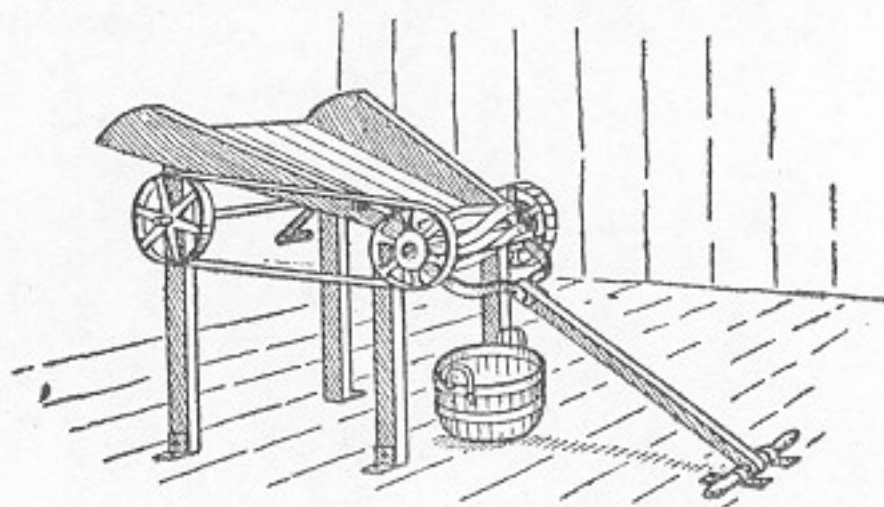


RACK FOR CORN HUSKING

will hold two or three shocks and gives a better place for the husker to sit. Place the stalks cross-wise of the bench in front of you.

A HOMEMADE FEED CUTTER

An old lawn mower can be arranged to make a fairly satisfactory straw or feed cutter. One must



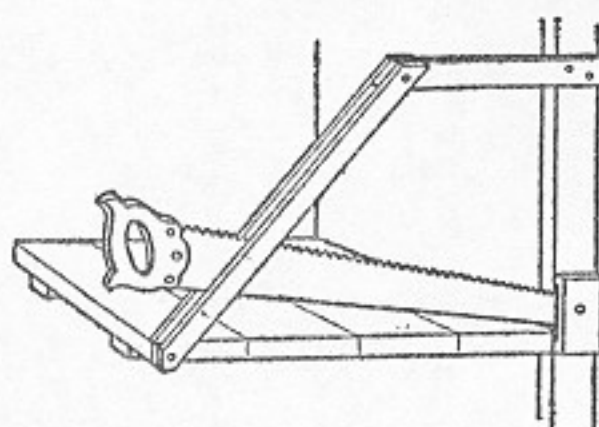
WORKING THE LAWN MOWER

113

rig up a hopper, as shown in the sketch, and attach the mower to the lower end of it so that the straw or grain will just strike the knives where the grass usually comes into the mower. A crank and a belt arrangement makes it easy for one man to feed and turn the cutter. This is a good use for a lawn mower in the winter time when it is not working outdoors.

SAW ROOT CUTTER

Those who have cut roots in the winter time with a butcher knife or hatchet will fully appreciate



ROOT CUTTER

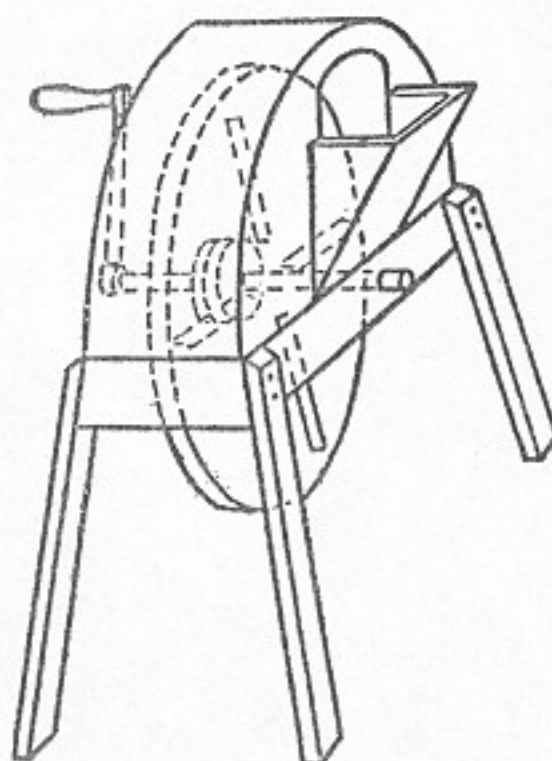
something better for a root cutter. A Wisconsin farmer has found a serviceable homemade lever cutter very efficient for all roots. For hard ones, like rutabagas, it is about the best thing available.

His is made out of an old hand saw, sharpened on the back, fastened by means of a bolt passing through a hole punched at the small end, and held by a guide formed of two pieces of wood secured upright, so as to have a slit for the saw to work in. This contrivance is a success, and with a little practice the roots may be cut very rapidly. See accompanying illustration. The cutter may be mounted upon the wall wherever it will be most convenient. The bench or platform should be at about the height of a common table.

114

HOMEMADE CABBAGE CUTTER

A cheap and easily made cabbage and root cutter is shown in the drawing. Take two



CABBAGE CUTTER

12-inch boards and nail them strongly together. With dividers mark around a circle, then saw out and mark in quarters. Cut four slots 7 inches long on a slant, as shown by dotted lines, so the cabbage will fall through easily. Next cut two circles 4 inches in diameter. Nail one to the large wheel on the back and leave the other loose on the shaft to act as a bearing.

Make a frame to admit the wheel, leaving 2 inches clear, and just wide enough so the knives do not strike the side. Make a top over the wheel and put a hopper on the opposite side from the crank. The knives are 8

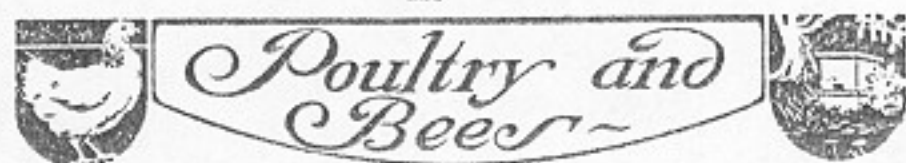
inches long and can be made from an old bucksaw and ground down sharp, with a bevel on one side. Screw these on the wheel at a slant according to the thickness the cabbage is wanted. A square hole should be cut through the center of the wheel for the shaft.

115

A SUBSTANTIAL DRIVEWAY

A plank driveway to the barn is usually made steep in order to save planks. It is continually wearing out and breaking. A substantial driveway with an easy grade can be made by driving down stakes close together on either side, and filling in between with stones, rubbish and earth, packing all down firmly. When full to the top, pack some earth against the outside of the stakes and sod over the sides. This driveway will form an easy rise and will prove very durable.

116

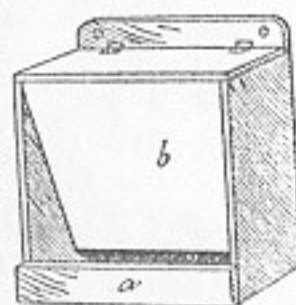


FEEDING DRY GROUND GRAIN



SOME of our friends have found that a poultry feed hopper for feeding ground grain has proved very satisfactory. Make a box 18 x 18 inches and 6 inches deep, then take off one end and fasten to the back with hinges, which forms the cover. Nail a strip, *a*, 3 inches wide across the open side at bottom, which forms the box for the poultry to eat from. Take a board, *b*, the width of inside of box, 14 inches long, and insert in front of box, nailing as shown in cut, with the upper end even with front edge of box and slanting in until a space of 2 inches is left between bottom of board and back of box to allow the feed to pass through.

The feed is poured into this hopper and runs down into the box at the bottom as fast as needed. The size of the hopper can be varied to suit the size of the flock. It should be screwed to wall of poultry house about 12 inches from floor. By using this hopper one may keep a dry mixture consisting of wheat bran and middlings and occasionally corn meal, or a small amount of linseed meal, always before the fowls. In addition, some people feed a mixture of whole corn, oats and wheat in the litter morning and evening, also ground green bone and beef scraps.



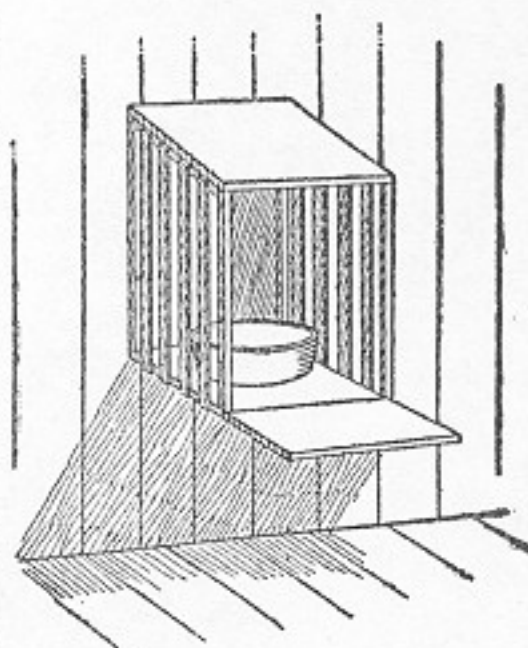
FEED HOPPER

117 KEEPING THE WATER CLEAN

Few drinking fountains are more successful than a large bottle or jug filled with water and inverted. It can be fastened wherever convenient with straps. If a small pan is placed close beneath it the water will flow out as it is used and will remain clean and cool. Place it high enough above the floor of the house so the fowls will not scratch litter into the pan.

A WATERING RACK FOR HENS

Build a crate of lath 2 feet square, 3 feet high, with a slanting cover to keep the hens off the top. Then tack an 8-inch board in front, level with floor of crate. Nail the rack to post or side of henhouse about 2½ feet from floor, and put your water pan in crate. The hens will quickly learn to fly up and drink by putting corn on the lighting board. This contrivance keeps the hens from spilling their water or scratching dust or chaff into it. Be sure to nail the rack securely to the wall or post where it is put up.

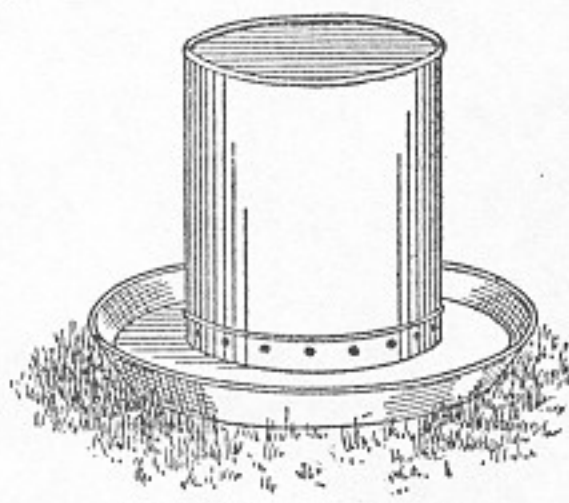


RACK IN PLACE

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DRINKING FOUNTAIN

The best drinking fountain, in that it is impossible for small chicks to get drowned, and they cannot stand in the water to befoul it, is made by inverting a can or pail in a pan a trifle larger. Tomato cans with the edges pounded down, leaky pails with the ears bent up, in fact anything with a smooth top and in which a hole can be made, can be used. Punch a hole or holes in the side just a little less distance from the top than the depth of the pan to be used. Fill with water, invert the

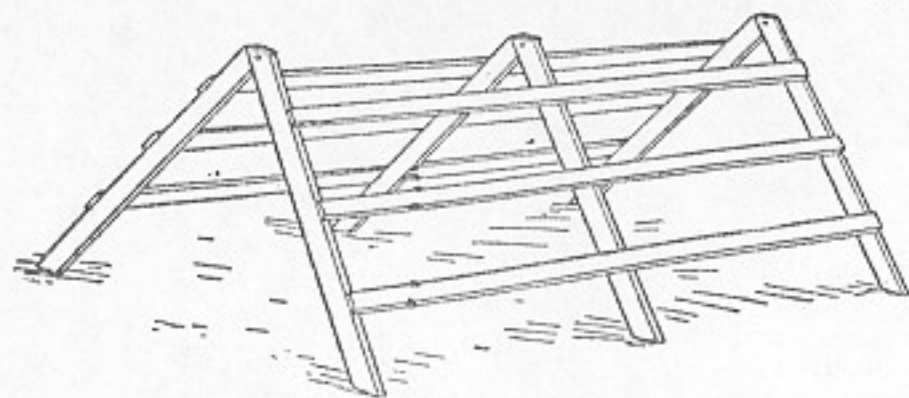


CHICKEN FOUNTAIN

pan over the top, and turn over quickly.

FOLDING CHICKEN ROOST

This roost is made of 3-inch boards cut any desired length. A small bolt fastens the upright



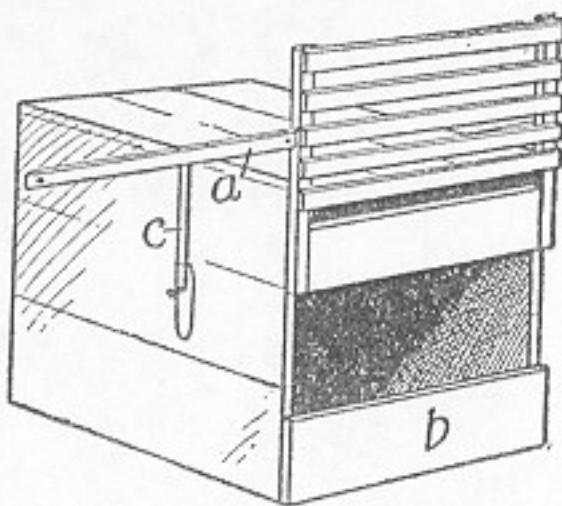
MOVABLE ROOST
119

pieces at their top ends, and the horizontal pieces are fastened on with nails. This roost can be kept at any angle, and may be quickly taken out of the house when it is time to clean up. This sort of roost will accommodate more fowls in the same space than the flat kind, but it should not be made very high.

A GOOD POULTRY NEST

A useful trap nest can be made of grocery boxes. They should be at least 12 inches each way. The illustration shows how they are made.

In the cut the trap is set ready for the hen to enter. A cleat, *c*, is fastened to a small piece of cord, which is tied to a nail on the side of the box. Set the trap by raising it and resting the cleat on the nail, with the other



TRAP NEST

end under the arm marked *a*. This leaves an opening from 4 to 6 inches wide, which is not enough for the hen to enter. In going into the nest she will be obliged to raise the trap door, which will let the cleat fall, thus closing the trap after the hen has gone in.

The trap door, the arms and the cleats may be made out of lath. Leave a little space between the boards in the walls, so the heat can escape, otherwise it will be too warm in summer. The bottom

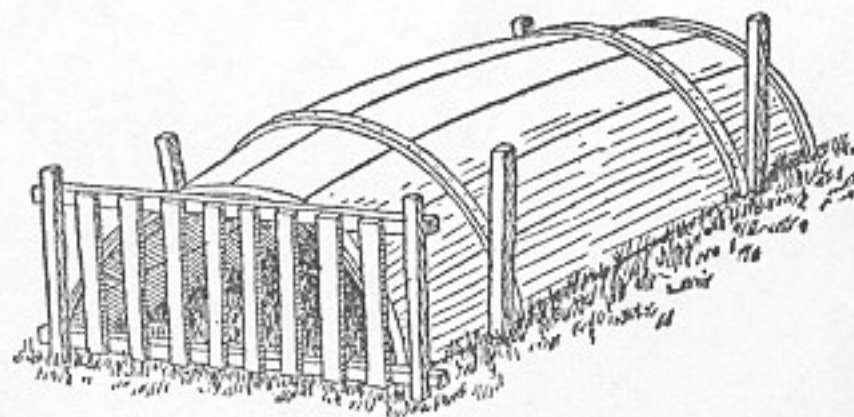
120

board, *b*, in front should be 3 or 4 inches wide, and the lower piece of the trap door should rest against

this so the hen cannot get her head through, raise the trap and get out.

TWO COOPS FROM A BARREL

Very good coops can be made at small cost from empty barrels, as shown in this picture. First, drive shingle nails through the hoops on both sides of each stave and clinch them down on the inside. Then divide the barrel in halves, if it is big enough, by cutting through the hoops and the



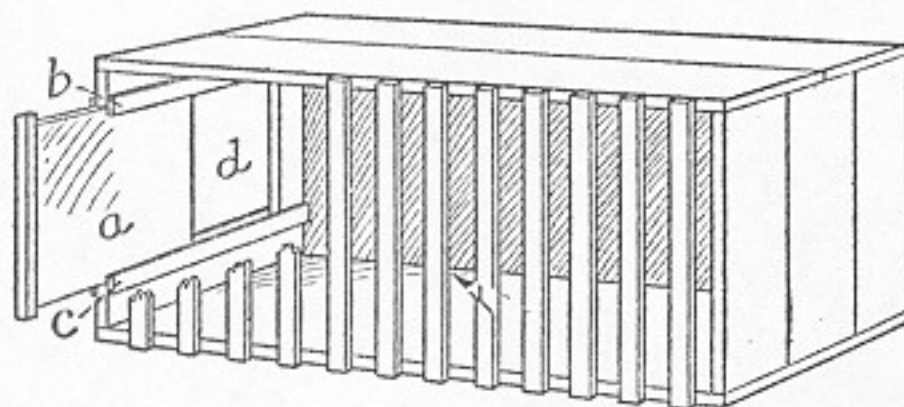
BARREL CHICKEN COOP

bottom. Drive sticks into the ground to hold the coop in place, and drive a long stick at each side of the open end just far enough from coop to allow the front door to be slipped out and in. The night door can be made of the head from the barrel or any solid board, and the slatted door, used to confine the hen, by nailing upright strips of lath to a crosslath at top and bottom.

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A BOX CHICKEN COOP

The diagram shows a convenient way to make a coop for the poultry yard, of which the special feature is its door. Procure a box of the right dimensions and saw a hole, *d*, in one end. Then strengthen the box with narrow strips of wood, *b*, *c*, on each side of the hole *b*, *c*. This acts as a



HINGELESS DOOR IN COOP

groove for the door, *a*, to slide in. Thus you have a sliding door, which opens and shuts with the greatest ease. The front of the coop is inclosed

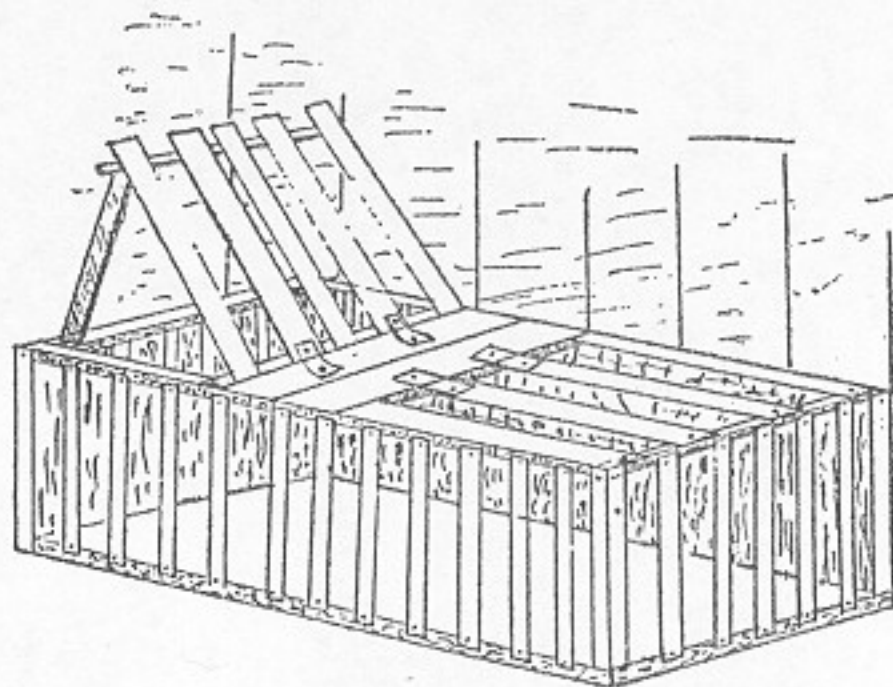
with lath, or narrow strips, placed $2\frac{1}{2}$ to 3 inches apart. The top should be covered with a good grade of roofing paper to make it waterproof. A coop of this sort should be 2 to $2\frac{1}{2}$ feet long, 16 inches deep and 2 feet high.

A LOW POULTRY RUN

A safe and secure run that requires less material than a high pen can be made from laths sawed in two, which would make the sides 2 feet high, making the frame of scantlings and the top of sawed laths, box boards or similar material. The top of

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the run should consist almost entirely of trap doors, using bits of old harness for hinges, which will look well if cut neatly. The picture shows one of the doors propped up to show the construction more plainly. The doors are 4 feet long, the length of a lath, and may be 8 to 10 feet the other way and still not be clumsy, being constructed of such light material. This trap door is an important feature,



TRAP-DOOR POULTRY COOP

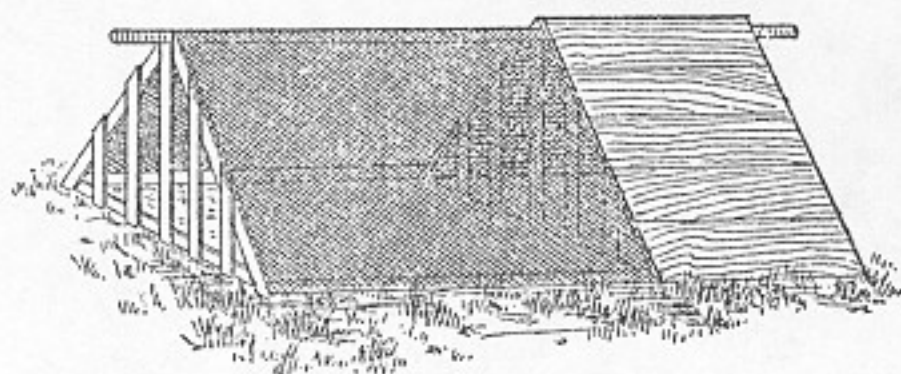
as it permits the tender to enter easily for removing top soil and replacing with fresh earth, or otherwise caring for the birds. The frame material is of 2 x 2-inch scantling at the corners, while the side strips are made of inch boards sawed 2 inches wide. The earth under this run should be slightly mounded for the sake of dryness.

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A PORTABLE CHICKEN COOP

One of the annoyances about an ordinary chicken coop is that it is not easily moved from place to place, nor provided with a yard. To obtain a yard the coop must be moved separately, and thus require the loss of more or less time. In the draw-

ing shown herewith is a simple, homemade coop,



COOP EASILY MOVED

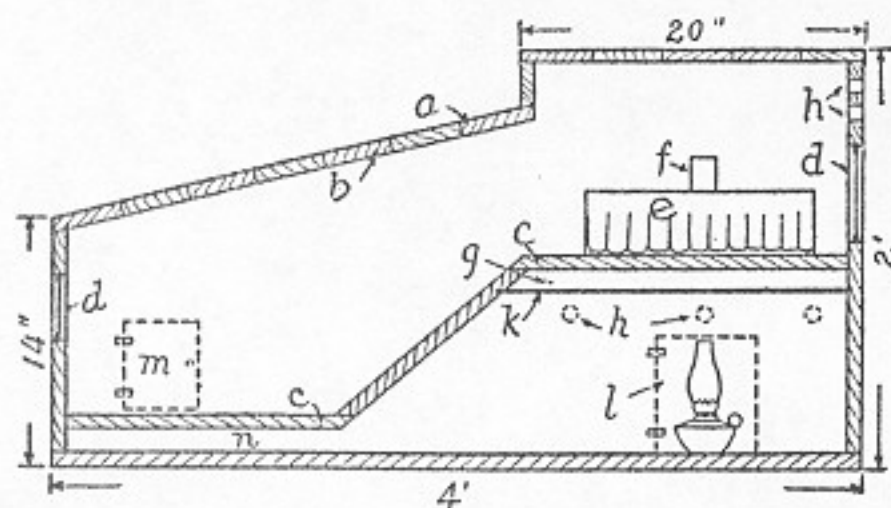
which can very easily be moved by the aid of the handles at the apex at each end. The coop is built of ordinary material on a base frame, and with a V-shaped roof and side frames. The ridge pole is extended, as shown at each end, to form a handle. A convenient length is about 2 feet for the coop and 3 or 4 feet for the yard. If desired, the hen may be allowed the freedom of the yard or may be held in by slats, as shown in the drawing.

A HOMEMADE BROODER

The material costs about \$2 and a handy person can build one in a day. The gas from the lamp does not go into the chick apartment at all, but filters around under the floor, making it dry and warm. The lamp flame is about 3 inches from the

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sheet iron. The heat flows up gently through the drum, *f*, which is perforated with holes in the side, thus letting part of the heat out into the hover and the balance in the brooder above. The heat reservoir, *g*, between the sheet iron, *k*, and the floor, *c*, is about 1 inch deep. The tube, *f*, should not touch the sheet iron, merely extending through the floor, *c*. It takes very little oil.



DETAILS OF BROODER

In the cut, *a*, is the paper roofing over inch-matched boards, *b*; *c* is board floor of same material; *d* are small windows, *e* is the hover, *h* are holes in each side of the brooder for the escape of gas and

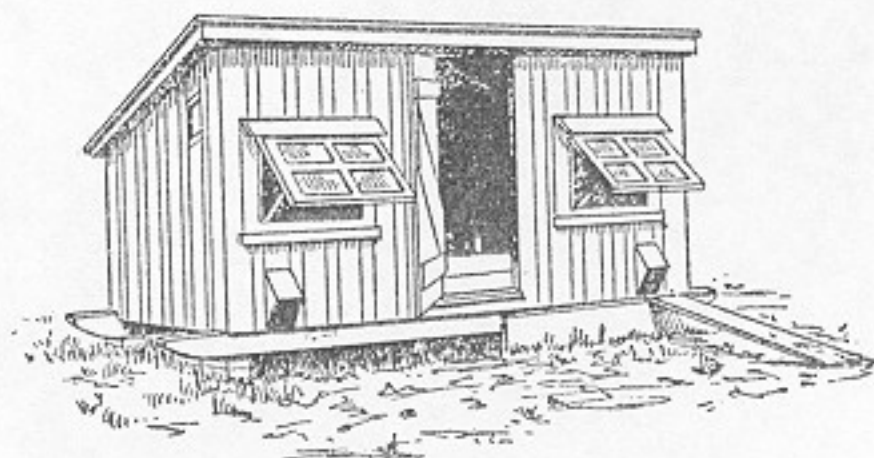
fumes, *l* shows door to reach the lamp, *n* air space below the floor.

MOVABLE BROODER HOUSE

The type of house shown in the cut is one of the best for raising poultry. It may be built on runners, with a tight board floor of matched boards. A convenient size is 6 feet wide and 10 feet long, 6 feet high in front and 4 feet at the rear. The

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door is in the middle, and there is a window on each side, with two openings below. The roof should be covered with a good quality of prepared roofing.



HOUSE ON RUNNERS

The same material used to cover the sides will make the house warmer. Roosts may be put in after the brooders are taken out, and the chickens easily protected from foxes and other animals.

A VERY CHEAP HENHOUSE

It was built by a "down east" Yankee. The studs and rafters were made of two pieces of 1 x 2-inch stuff nailed together T shape. These were set up 2 feet 10 inches apart on centers and covered with wire netting drawn taut. This was then covered with tarred paper, which made the only material between the fowls and the outside air. They have wintered in these houses without discomfort, and gave a good egg yield. The wire netting prevented the paper from sagging when the house was covered with snow.

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A DAYLIGHT CHICKEN CATCHER

Do you, when you want fried chicken on short notice, run it down, provided it doesn't run you down? Here is a better way. Fasten a barrel hoop securely to a handle about 6 feet long, and to it fasten a bag about 3 feet deep. A piece of an old hammock is fine for a bag, or horse net or fish net—anything the chicken cannot get out of. Lay it on the ground, call the chicken and throw the corn

over the bag, and when one suitable goes on lift up the hoop and you have it. If the bag is made not over 1 foot deep it can be dropped down over the chicken while eating.

A SIMPLE HAWK TRAP

Make a box 4 inches deep, 6 inches square and nail to a 4-foot pole with cleats at the bottom to keep from turning over. Cover top of box with 1-inch mesh wire. Place a little chicken in the box; then put a steel trap on top of box and set it out under the trees where the hawks lodge to watch for the chickens. If there are hawks around, it is pretty sure to catch them.

SCARE AWAY CROWS AND HAWKS

For keeping hawks and crows away from the poultry yards, get a few bright tin shingles, link them together with wire, and hang upon an arm extending from the top of a high pole, where sun and wind strike fairly. The jingle and glitter is sufficient to keep these pests at a safe distance. You will also find them useful in the corn and melon fields where crows are troublesome.

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PRACTICAL HIVES AND HIVE MAKING



VERY apiarist knows that there is no item in bee keeping of more practical importance than the hive and brood frame. The Langstroth, or Simplicity size of frame has become almost standard, for there are more frames of this size in use than all others combined. The frame proper is 17 $\frac{5}{8}$ inches long, 9 $\frac{1}{8}$ inches deep, and the top bar

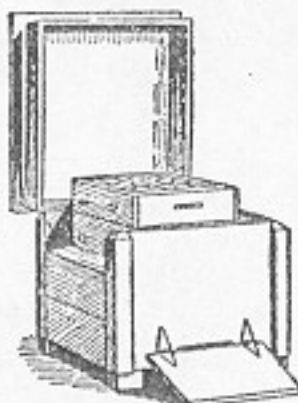


COSTS LITTLE AND SAVES MUCH

If you can't afford an expensive spraying outfit, rig one up like this.

is 19 inches long. There are several styles made, but many prefer what is known as the Hoffman. This has a heavy top bar in depth, as well as width. The ends, or end bars, are made $1\frac{3}{8}$ inches wide for about 3 inches down and one side is worked off to a knife edge, which comes against the square edge of the next frame, making them self-spacing, but not a closed-end frame, and allowing the proper bee space between the top bars. This works fairly well without the use of the honey board, though one is preferable.

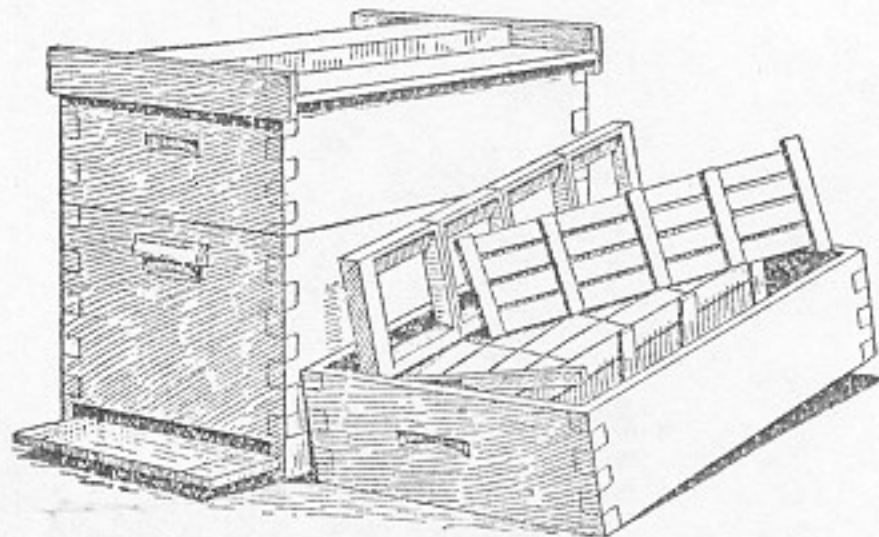
The hive for this frame, to be best adapted to the production of comb or extracted honey, should contain 10 frames, the inside dimensions being 15 inches wide, 10 inches deep and $18\frac{3}{8}$ inches long. A follower can be used at one side to assist in removing frames by first removing the follower or division board. This arrangement leaves $\frac{3}{8}$ inch between the top of the frames and the top of the brood nest, so that when the surplus cases are put on the proper bee space is



DOUBLE-WALLED
HIVE

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preserved. This hive is made of scant $\frac{1}{2}$ -inch lumber for the outside, ship-lapped together in a manner to make a perfect joint. It is 20 inches wide, 24 inches long, about 20 inches high to the eaves, or roof, outside measurements, and weighs complete about 50 pounds. The inside dimensions of the brood nest should be the same as any 8 or 10-frame hive, as the bee keeper may prefer. The brood nest is raised sufficiently to admit of packing between it and the hive proper, also a space for packing at ends and sides.



DOVETAILED HIVE

The lower portion of the hive being well protected against the cold, the warmth of the bees

will care for the upper portion. To avoid condensation cover the brood nest after removing the surplus cases with a porous substance, or chaff cushion. Make a wooden rim about 4 inches deep, covering the top and bottom with burlap and filling with wheat chaff or cut straw. Many prefer the cut straw both for cushions and packing the

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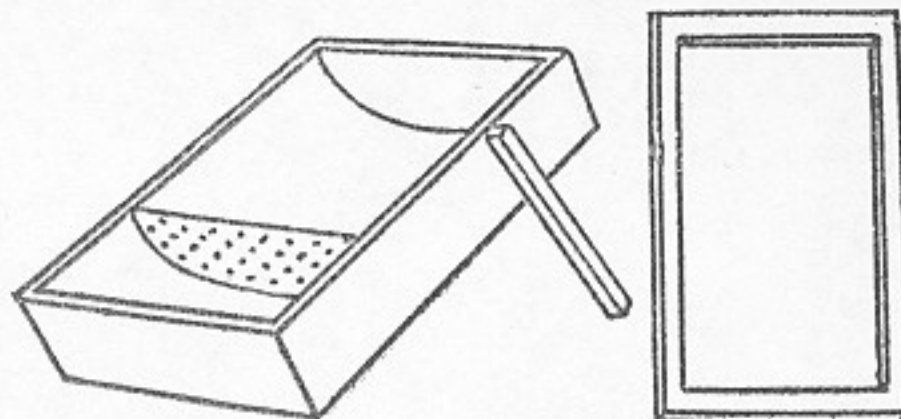
hives. This rim should be made a little smaller than the inside of the hive.

In extremely warm weather the cover can be raised a few inches in front, giving a circulation of air all around the surplus department, and shading it at the same time. The cover is hinged at the back end, and when raised, as shown in cut, makes two shelves for the use of the operators, which are highly appreciated; besides, there is no lifting on or off of covers, as is the case in other hives. The alighting board is hinged and can touch the ground, which is of great advantage to the bees during a heavy flow of honey.

Perhaps there are more single-walled hives used in the United States than double-walled or chaff hives, but in northern states a double-walled hive is preferable.

DEVICE FOR EXTRACTING BEESWAX

Wax, as produced by the bees and worked into comb, is almost pure white, but, on being melted



SOLAR WAX EXTRACTOR

and cooled, is yellow. A man who knows advises every beekeeper to use the solar wax extractor.

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All that is necessary is to have a box with glass to fit over it, as shown in the drawing. To melt combs, put in the box an old dripping-pan, having a hole at one corner, and that corner the lowest, with some kind of a dish set under to catch the wax. Set in the sun. To get the most out, break up the combs into fine pieces, then soak in water for a day or two longer before rendering.

SELF-FEEDER FOR BEES

A very simple device for feeding bees on syrup

may be made if you take an ordinary fruit can, fill it full of syrup and over the top tie a thick rag with a string. Then invert the can in a small pan or dish. The syrup will seep out through the rag around the edges of the jar just fast enough for the bees to keep it cleaned up.

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AN IRON HOOP TRELLIS



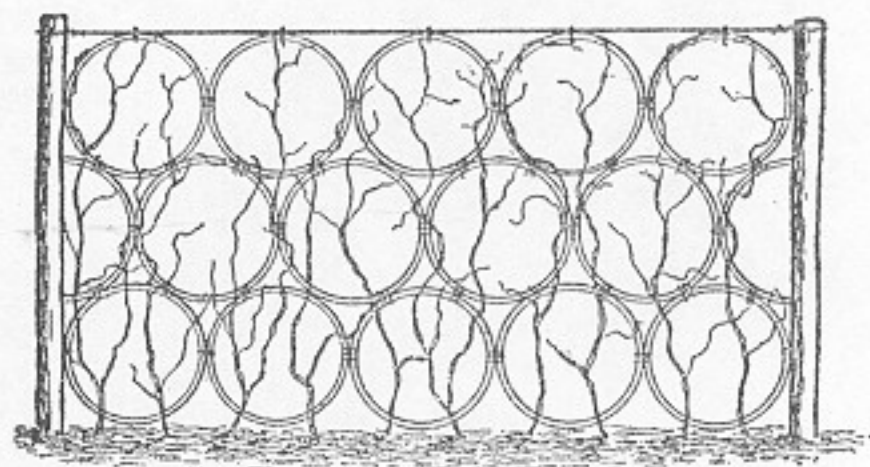
THIS trellis is made of the iron hoops that are now used so commonly upon sugar and other barrels. They are of stout wire, welded into a complete circle, and, as barrels are constantly going to pieces, one can get together quite a collection of these, when they can be assorted into uniform sizes.

An attractive trellis is shown. Three strips of wood, pointed at the lower end and finished with a knob at the top, are provided, the length being a matter for individual taste. A trellis for tomato plants will need not more than two hoops, while one for sweet peas may require a half dozen. The strips of wood should be of inch board, 2 inches wide. The hoops are secured to the uprights by small staples made for putting up wire fencing. The wooden posts may be oiled or painted some attractive color. This trellis will be greatly appreciated both in the vegetable and flower gardens, for its strength and attractiveness.

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PLANT SUPPORTS OF BARREL HOOPS

The ordinary wooden hoops from barrels may be



made into an attractive trellis for grapes or a support for smaller twining plants by being arranged



HOOP TRELLISES

as shown in the sketch. Attach them firmly to heavy stakes with some No. 7 smooth wire and you have an arrangement which will last for several years and is not unattractive to the eye.

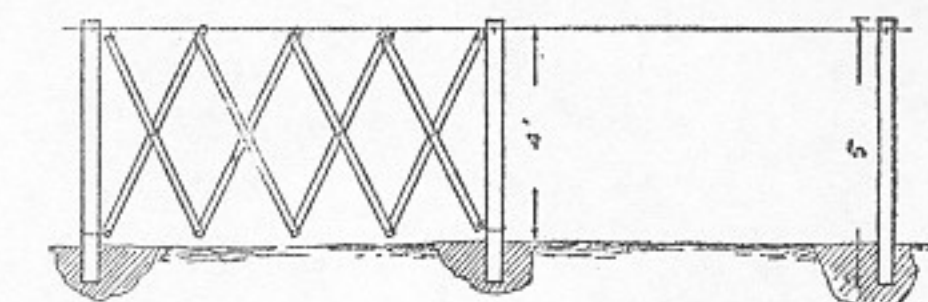
A FOLDING TRELLIS

A good way to pole beans is to make a folding trellis out of plastering lath, as shown in the cuts.

Bore three small holes through each lath, as shown in the first cut and fasten them together with common wire nails well clinched.

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Five-foot posts are set 1 foot in the ground and a wire strung at top and bottom. The lath are fastened to the wires with string, as shown in the second cut. The trellis is made in sections so as to be

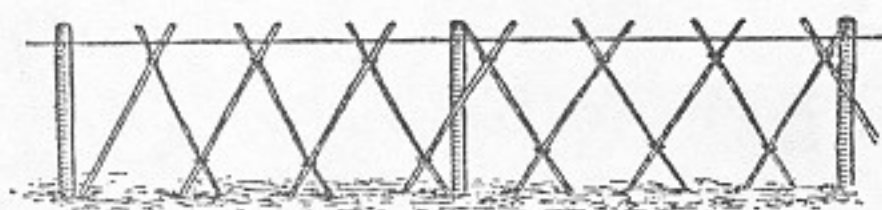


TRELLIS IN PLACE IN THE GARDEN

easily handled. When not in use it is folded up and laid away under shelter. The posts are spaced evenly so that one section of trellis will just go between two posts.

EASY WAY TO POLE BEANS

Set posts at convenient distances apart and stretch a wire at the top. This may be done as soon as ground is plowed. Plant and cultivate one row each side of line until beans begin to vine, then



TRELLIS FOR BEANS

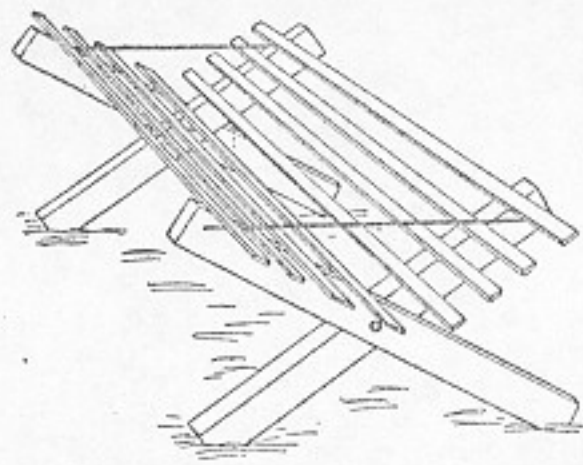
set poles slanting, tying them together where they cross at the wire. This braces the whole row and

beans can be cultivated with hoe. Hills 3 feet apart in row with one vine to hill are better than two vines.

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TRELLIS THAT STANDS ALONE

A plant support or garden trellis, such as shown in the drawing, is very handy in the garden. This



DOUBLE FORM OF TRELLIS

double form of trellis can be folded up and takes very little room in storage. All trellises and stakes should be gathered as soon as the crop is harvested and stored under cover until the next season.

They are useful for tomatoes, beans, peas, cucumbers and other plants that need some support. The double trellis is built of narrow $\frac{1}{2}$ -inch slats and pieces of 2 x 3, which are bolted together for the legs. The top may be held in place by pieces of string or wire attached at the points indicated in the drawing. The length, width and height of this trellis should depend upon the use to be made of it. A large one will be wanted for a large spreading plant and a small one for a small plant. It is important to have trellises just the right size to give proper support.

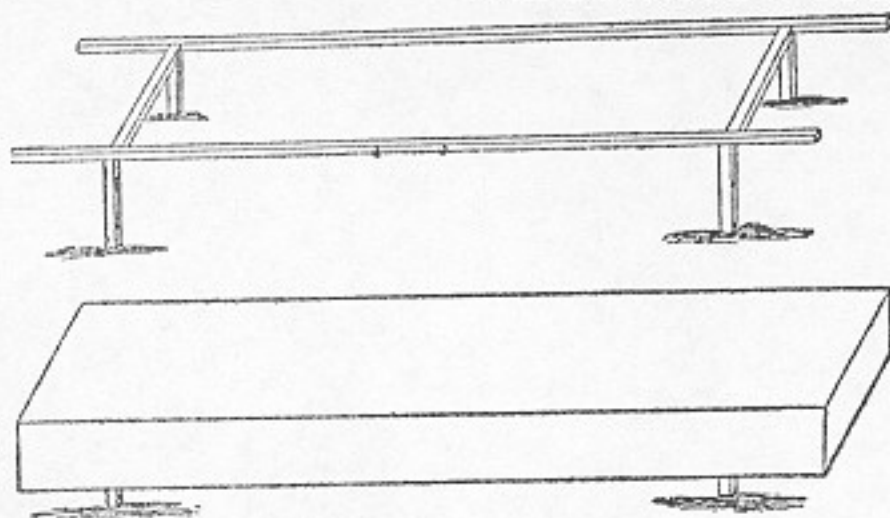
PROTECTING NEWLY SET PLANTS

Plants newly transplanted always demand more or less protection from the blighting effects of too much sun and wind. It is best achieved by making a shelter such as is shown in the cut. Two 10-

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foot poles and two 3-foot pieces of any convenient thickness for the crosspieces, with four 14-inch weather-strips for the legs, constitute the frame. In the middle of it two hooks should be inserted on each side, and upon these the covering fastened, which can thus be adjusted very quickly. The covering may consist of burlap or any kind of rough sacking.

Being so simple and economical to make, it is advisable to have enough frames to protect the number of tender plants that are set out in a garden at one time. They possess other advantages than sheltering the young things from the direct rays of the sun. They allow slow evaporation, and



FRAME OPEN AND COVERED

so keep newly watered ground moist for hours, whereas if exposed to the sun and wind it would soon become dry and caked. On windy days it is only necessary to let the sacking down on the windward side of the shelter. In case of frost the protection that they afford is of inestimable value.

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MAKING THE HOTBED

The value of every vegetable garden can be greatly increased and the time during which a supply of fresh vegetables may be secured for the table greatly lengthened by the use of the common manure hotbed and the cold frame. These indispensable adjuncts of the good garden are so easily made and cost so little that it is surprising they are not more common. A good hotbed made the latter part of February or in March can be made to yield an abundant supply of lettuce, radishes, spinach, etc., for table use by the time such crops are being planted out of doors, and the supply of cabbage, tomatoes and other plants for the home garden can be secured ready to transplant several weeks earlier than if plants grown in the open were depended upon.

As a source of heat fresh horse manure is used. About half manure and half fine straw mixed together should be piled in square piles 2 or 3 feet in depth, and 4 or 5 feet in width and long enough to contain the amount necessary for the beds desired. After heating has well started, the piles should be forked over, turning the outside of the old pile to the inside of the new, and when heating again is well under way the material is ready for use. In the meantime select a well-drained spot, sloping to the south, if possible.

Dig a trench $6\frac{1}{2}$ feet wide, 2 feet deep and as long as desired, running east and west. Now place the manure in the trench, tramping and packing in thin, even layers until level with the surface. Make a frame 6 feet wide and as long as desired, but some multiple of three, because the hotbed sash are always made 3 feet wide. The end piece should

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be 9 inches high in front and 15 inches high in the back. The front side board should be 9 inches wide and for the rear it will require two boards, preferably 12 and 3, with the wide one at the top.

A frame 12 or 15 feet in length will be quite large enough for the ordinary farm garden. Set this frame on top of the manure with the slope facing the south and secured by stakes. On top of the manure put 6 inches of good garden soil and cover the frame with common sash or windows 6 feet long by 3 feet wide. At first the heat will run very high, but in a few days it will fall to 80 or 90 degrees, when it is safe to plant the seeds.

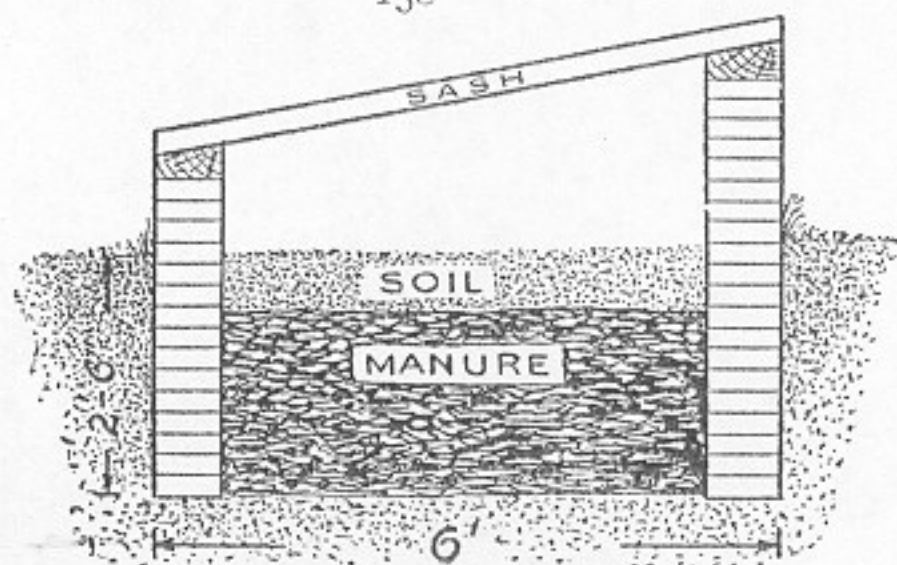
MAKING PERMANENT HOTBEDS

Hotbed sash should be constructed of white pine or of cypress, and the sash bars should run in one direction only, and that lengthwise of the sash. The bars may be braced through the middle by a transverse bar placed through the long bars below the glass. The two ends of the sash should be made of sound timber, 3 inches wide at the top and 4 inches wide at the bottom end, mortised to receive the ends of the sash bars, and with a tenon at the ends to pass through the side pieces, which should be 2½ inches wide.

A permanent hotbed should be so constructed as to be heated either with fermenting manure or by radiating pipes from the dwelling or greenhouse heating plant. For a permanent bed, in which manure is to supply the heat, a pit 2 to 2½ feet deep, according to the latitude in which the work is to be done, should be provided.

The sides and ends may be supported by a lining of plank supported by posts 4 feet apart, or, what

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HOTBED WITH BRICK WALLS

is better still, a brick wall 9 inches thick, as shown in the drawing, may be used. In either case the pit lining should come flush with the surface of the

soil. The site for the pit should be on naturally well-drained land, and a tile drain from the bottom of the excavation should be provided to prevent the water from accumulating in the pit and stopping the fermentation of the manure during the period the hotbed is in use.

Standard hotbed sash are 3 by 6 feet. The pit, therefore, should be some multiple of 3 feet in length, and the width should be the same as the length of the sash, 6 feet. The plank frame, or the brickwork of the pit, may be extended above the surface of the ground sufficiently to allow for placing the sash immediately upon these permanent structures.

HEAT FOR HOTBEDS

Make an excavation 5 x 16 feet on the surface, and about a foot deep. Lengthwise along this

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space lay three rows of tiling, one along the center and one about a foot from each side. The tiles should be 4 inches inside measure, and 1 foot long. These are placed end to end so as to fit closely, and earth is pressed around them so as to hold every piece exactly in place. Then the excavation is filled with rich soil until level with the surface, excepting at the end the tiles are left bare for a few inches. The board frame, 5 x 15 feet, is next put in place so as to leave 6 inches of each row of tiles projecting beyond the ends of the frame.

At the east ends of the bed, a hole should be dug 3 x 4 feet on surface and 2 feet deep; in this hole a crude fireplace may be made of loose brick and the flue connected with the three ends of projecting tile. At the west end of the frame a brick chamber should be made into which the three tiles enter, giving them a common flue for outlet. Cover the top of this chamber closely, excepting a 6-inch circular hole, into which a single length of stovepipe is fitted. A sloping door is hung over the fireplace cavity to keep out the rain; and the earth raised high enough around to prevent surface water from running into the hole. Bank soil about the frame. You may happen to have on hand six old storm window sashes of that size. Of course the sashes slope to the south in the usual way.

When the fire is kindled in the fireplace the smoke comes freely from the stovepipe. The tiles are covered with soil to a depth of about 6 inches. With a good fire, you can quickly warm up the earth on the coldest days of spring. And when once well heated, the earth and tiling hold the heat for a long time, provided the draft is closed. Unlike beds heated with manure, the heat supply can thus

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be regulated to suit the demand of the prevailing weather.

COLD FRAMES AND THEIR MANAGEMENT

In the South cold frames are in use all winter. The principal winter crops grown are lettuce, radishes, beets, cauliflower and occasionally cabbage, while these crops are commonly followed in spring by cucumbers, cantaloups and sometimes Irish potatoes. The frames are easily made. Rough inch lumber (heart pine is best in the South, and hemlock in the North) and 2 x 4 or 2 x 3-inch scantling are all that is required. For the double frames, strips 3 inches wide and $\frac{3}{4}$ or $\frac{1}{2}$ inch thick, long enough to extend across the frame, should be provided for rafters. The back or north side of the single frame should be 12 or 15 inches high, while the front should slope down to 8 inches. In Southern practice, where canvas covers are used, the back should be 2½ feet and all cracks should be well covered with building paper, held in place by laths tacked over it.

Good treatment for the posts used in construction is to dip them in kerosene over night. This will preserve them indefinitely. Drive the posts into the ground 18 inches and let them extend upward to the top of the boards, putting a post at the union of each pair of boards and nailing them to it. All ends and rafters may be made so that they can be quickly removed, so that the frames can be plowed and the ground prepared with a mule. The sides of the double frames are best made 1 foot high, with the ends sloping upward to 2½ feet. Down the center of the frame, a row of 2 x 4-inch posts 2½ feet above ground are set 8 feet apart.

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Over each one of these a rafter is bent and fastened to the sides of the frames.

For cold frames in the North, glass is the only covering to be thought of. By all means, put the frames up facing the south or southeast and to afford protection against the north and northwest winds, cold the country over, a high wall, a thick hedge, or a piece of thick woodland should be close at the back of them.

The soil in the frames should be thoroughly prepared, rich and pulverized thoroughly. An abundance of well-rotted stable manure should be used; if thoroughly decomposed, at the rate of 75 to 100 tons an acre is not excessive, unless the soil is already very rich. Whether glass or canvas is used as a covering great attention must be given to water and ventilation. The land should be well

drained that no water will stand, or the soil become water logged; that is one side of the water question, but in addition, the plants should be carefully watered from time to time to provide sufficient for their needs.

If the coverings are kept down too constantly, the growth of the plants will be weak and spindling and such diseases as damping off, Botrytis and drop will work havoc with them. Careful attention to watering, ventilation and keeping the surface of the ground stirred are the genuine secrets of controlling these pests. Watch the temperature, do not let it rise too high, lower it by raising the sash or drawing back the covers. The canvas covers should be drawn back a portion of every day when the temperature is not too low, and at other times the ends may be raised, to allow the air to circulate under them. A sharp eye must be kept on the

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frost item. Sometimes steam heat is provided, oil stoves may be used and glass covered frames should be covered with burlap or straw mats, securely held down either by tying them in place or by weighting them down. Both canvas and the glass covering should be well fastened to prevent their being lifted off by strong winds.

The upper end of glass sash may be held down with a hook and staple, a hook being placed on the back of the frame at the center of each sash with the staple in the end of the sash. Canvas covers are best held down by nailing along the center to a board run lengthwise on the center of the rafters, in the case of double coverings, or along the back in the case of single ones and by placing marbles or small pebbles in the cloth and tying about these every 4 or 5 feet, along the ends and sides, slipping the looped ends of the twine used in tying them over nails driven into the ends and sides of the frame.

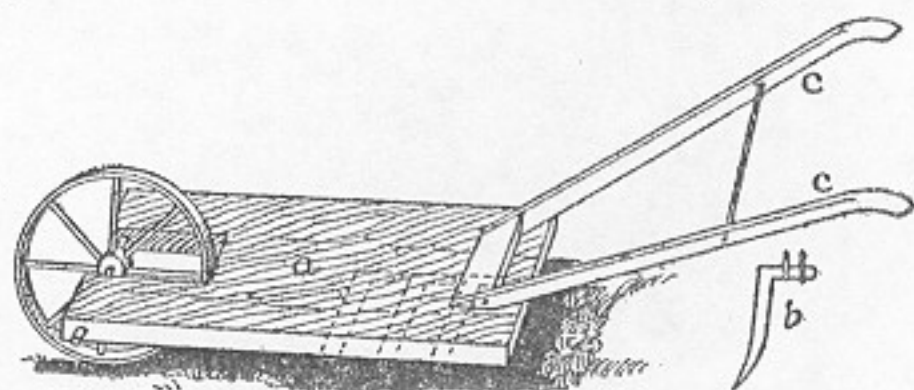
A HAND GARDEN CULTIVATOR

Now that garden crops are planted almost exclusively in rows a tool that will clean out the weeds, stir the soil around the plants, and, by making a good surface mulch, prevent the loss of moisture to some extent, is essential for the proper care of the garden. The wheel hoe of our cultivator is usually used for this purpose by the professional gardener, but the price is generally considered rather high by the ordinary farmer or amateur.

This machine, although homemade and not very handsome in appearance, does the work as well as a \$6 or \$8 tool, and cost not more than 40 cents

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to make. For a wheel, take the fly wheel of an old sewing machine, about 1 foot in diameter, and put a round bolt tightly through the axle. Then a piece of plank, *a*, 20 x 10 inches, and cut as shown, boring holes for the axle where marked. After the wheel is set in place, it should turn easily and steadily, if balanced properly. For the handle, *c c*, cut out and round from a piece of plank two pieces, or use any that may be otherwise obtained. Then get a blacksmith to make three teeth, *b*, out of a



HAND CULTIVATOR

piece of spring steel 1 inch wide and 8 inches long, bent as shown. Two-inch holes are drilled through them for screws.

One tooth should be placed about 6 inches behind the wheel and directly in the center, the other two being 4 inches behind the first, and the same distance from the center tooth. When this cultivator is pushed through the rows it should run with little pressure from the operator, clearing out the weeds and stirring the soil at the same time. This contrivance does the work well, and if given two coats of brown and green paint it will be improved in appearance.

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A CONVENIENT GARDEN STOOL

This device will prove useful in doing hand work in the garden. It is made from two barrel staves upon which is mounted a low stool. This should be narrow, so that it may be drawn between the rows of vegetables. The holes in the seat are large enough for the fingers to go through and render the stool more easily handled. The device is especially convenient for the women.



WEEDING STOOL

WATERING SEED SOIL MADE EASY

To avoid disturbing small seeds by watering, when planted in forcing boxes, a plan has been devised which not only insures against the disturbance of the seed, but keeps the soil of the entire box in a moderate state of moisture, which is

an essential feature in early growth.

Make a box of any desired size to suit the occasion, and about 3 inches deep. Then get a few small unglazed flower pots and place same on stove until quite hot. With a short piece of candle, seal drain hole in bottom of pots, taking care not to put wax over the entire bottom of pot. Place pots in box about 9 inches apart on a thin layer of sand, and overlap pieces of broken pots, to convey by capillary attraction the water to the entire soil of the box, which soil should be sifted and box filled to within $\frac{1}{4}$ inch of the top of the pots.

Cover the box with glass, and heat from above will draw the water up to the roots. By this method you will not have surface baking, which is so troublesome with surface watering. If so desired,

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you can cover the pots with circular pieces of pasteboard or tin, and avoid surface evaporation from the pots. Always fill pots with warm water.

CATCHING OWLS AND HAWKS

A friend of ours captured a large owl and fastened him securely with a small chain to a stake in the middle of an open field. He set three posts 5 feet tall and 4 to 5 inches in diameter 20 to 30 yards from the owl, and on each post placed a small steel trap with a bunch of hay or grass tied to the post just under the trap, to hide it, as shown in cut. At night, the owl called. Others came, and seeing nothing near, alighted in the trap on the post. During the day hawks came, and were caught in the same way. In two months two owls and 17 hawks were caught. In some places a bounty is paid, so there is a profit in two ways. The owl may be fed on the hawks caught and on rabbits or chickens that may die around the premises. The most difficult part of this scheme is often the capture of the first owl, but if you are a good hunter you will find a way.



TRAP ON POST

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MOVING A LARGE TREE

To move a large tree one may find it very satisfactory to use a rig similar to that shown in the picture. Make a three-sided standard of 2 x 4-inch stuff. Loosen the dirt around the roots of the tree and wrap the tree firmly at the base with old carpet or burlap to prevent injury. Place the



RIG FOR MOVING TREE

standard firmly in the ground and tie the cross-piece to the body of the tree with strong rope to each side of the standard and hitch a horse to the

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other end. With a slow pull the tree can be drawn onto the drag and then hauled to the new location. It can be placed in the ground again by using the standard in the same way it was used to load it upon the drag.

TRANSPLANTING TREES

Here is a way to transplant large trees that is not so difficult as such transplanting is by many supposed to be. The first move to make is to dig all round the tree, leaving a large ball of soil, which is carefully wrapped in sacking or canvas to hold it on the roots and prevent drying. When this is well tied in place a chain is passed round the ball two or three times and hooked, as shown in Figure 1.

Then with a pair

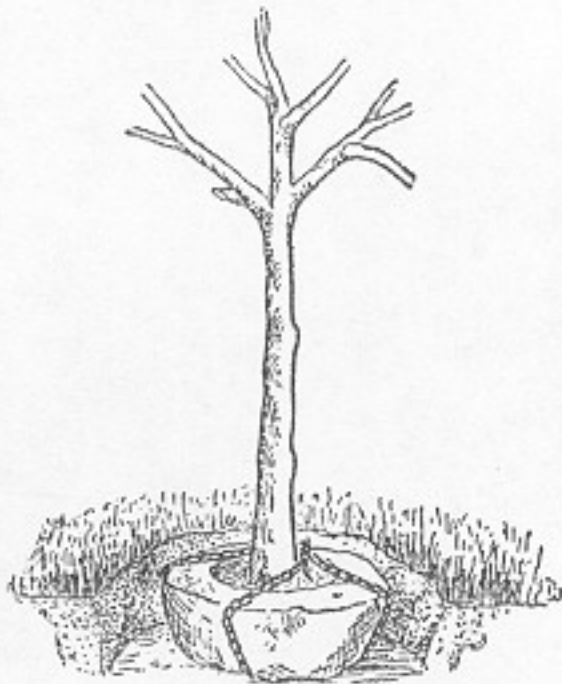


FIGURE 1—BALLED

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of heavy wheels on a short axle and a strong pole laid across it, with a massive iron hook fastened to

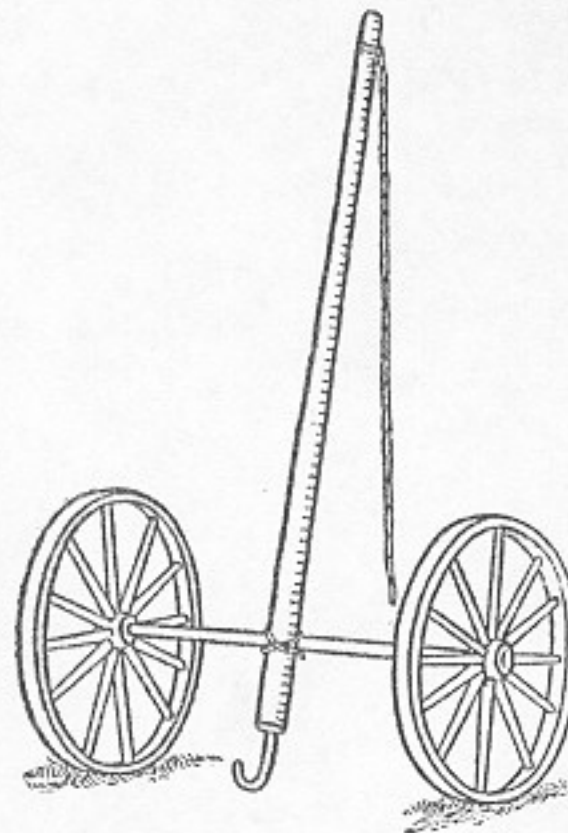


FIGURE 2—HOOK AND TRUCK

the pole, it is easy to back up to the tree. The sketch, Figure 2, shows the truck with its lever raised ready to hook into the chain. The rope at the end of the pole brings it down and the tree up, when the pole is fastened under a second pair of wheels. The young trunk must be kept from contact with the machinery by the free use of blankets and bags. The secret of success in transplanting trees is to injure the roots as little as possible.

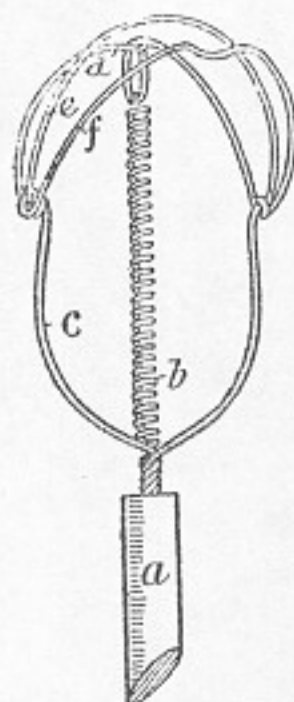


THE BIG BROTHER TAKES A HAND

He's a city chap now, but when he comes home, he proves that his early training has not been forgotten. Teach your boy to use tools and use them right.

HOMEMADE FRUIT PICKER

This is a device that is hard to beat for reaching fruit at the top of tall trees. After a little practice, a man can operate it rapidly, far outstripping hand pickers and at the same time not



WIRE DETAILS



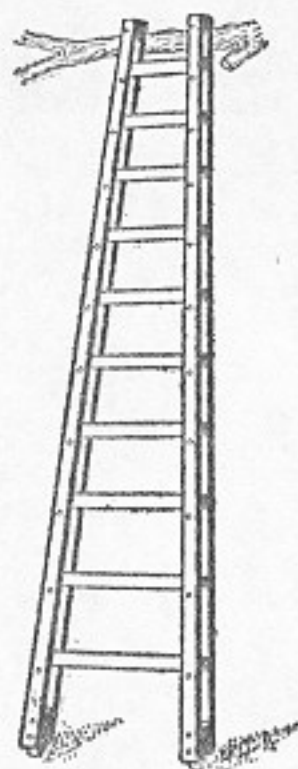
THE PICKER IN USE

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devices have been made for this sort of service, but it will be hard to find one that works better than this one if constructed in the exact shape indicated.

A TRUSS LADDER

For a 14-foot ladder select four pieces of 1 x 2 hard wood, using two pieces for each side. Place



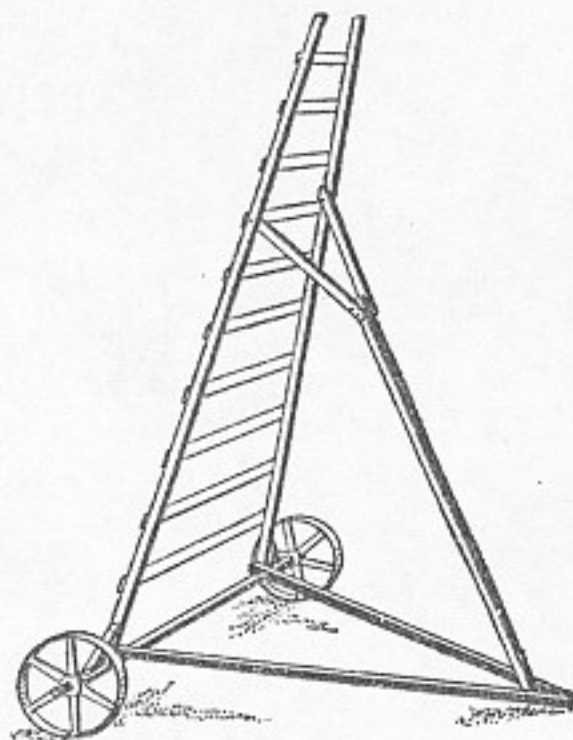
THE LADDER

combined, as in the case of this particular ladder.

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ORCHARD LADDER ON WHEELS

The accompanying sketch shows the manner of construction. Any farmer or orchardist can build it. Secure two old mower wheels and one piece of 2 x 4 scantling for an axle. Place the ladder upon this scantling. To keep it upright use poles, two at the bottom and one near the top of the ladder, extending to the ground. The upper one should be forked at the top so as to hold the ladder firmly. This ladder is 18 feet high, and as the foundation is broad, there is no danger of it falling over. The brace is so made that it can be adjusted, thus enabling one to place the ladder at any angle.



LADDER FOR FRUIT TREES

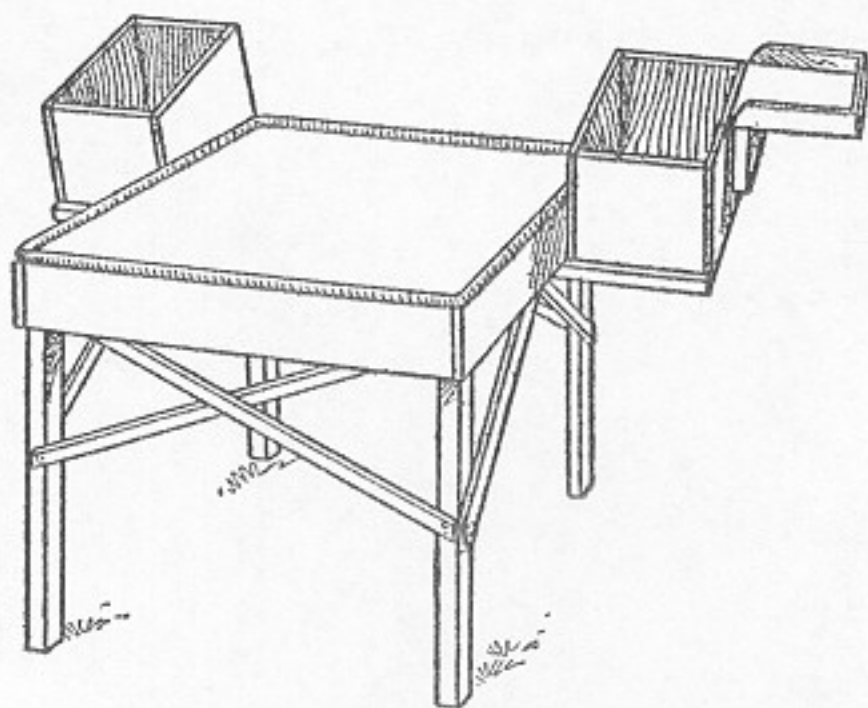
CONVENIENT SORTING TABLES

Where fruit is packed from the trees a sorting table will always be found convenient. It generally saves time and labor to do the packing right in the orchard. A handy table is one mounted on wheels

which may be of any size desired and should be large enough to hold at least four barrels. The

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wheels can be picked up from discarded machinery or quickly made by nailing together crosswise two boards to prevent them from splitting, boring a hole in the center for the axle and rounding them off with a key hole saw. One end of the table should be made several inches higher than the other, so that the culls will roll into a pile at the lower end.



OREGON SORTING TABLE

In the Hood river district of Oregon a table such as shown here is commonly used. This is made to accommodate two packers. To make such a table take four standards about 3 feet high. It is made 3 x 4 feet in size, the top covered with strong burlap or canvas and allowed to hang rather loosely. Saw off the tops of the legs on a bevel so as not to have the sharp corners push into the burlap, and make points that will bruise or cut the fruit.

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A piece of old garden hose is generally nailed around the top of the table to protect the fruit. Besides the braces shown in the cut it is also well to wire the legs and braces together firmly, as there is a heavy load to support. The shelves on each side are for holding the boxes, as all the good fruit in this region is boxed. The height is only relative, the point being to construct it so each packer can work with the greatest comfort, avoiding back bending in all cases. The top should not be greater than 3 x 4 feet, as anything larger would not allow two packers to reach all points of it without unnecessary stretching.

FIELD AND WOOD

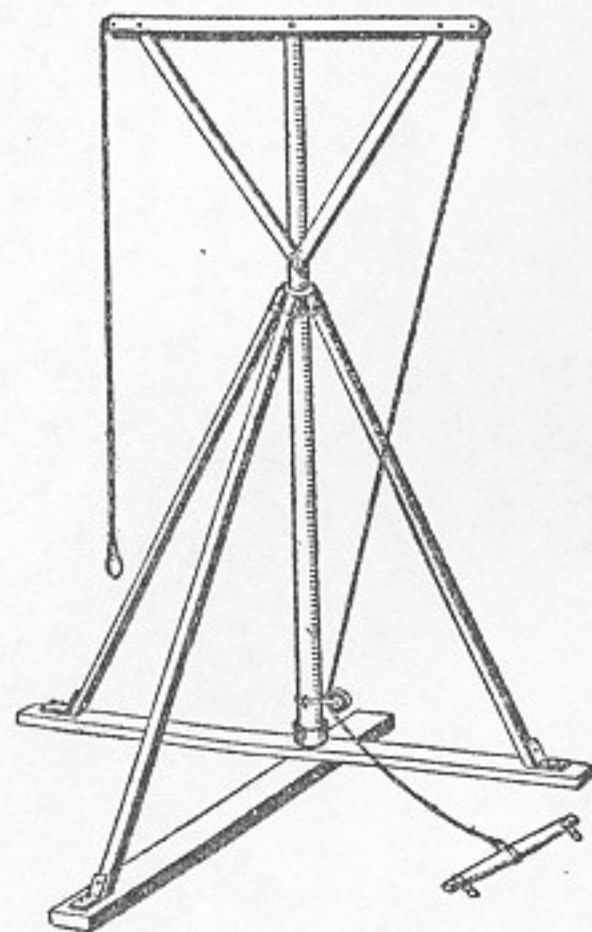


PORTABLE HAY DERRICK



VERY satisfactory derrick for stacking hay is shown in the sketch. The base pieces are 6 x 6 inches by 16 feet. For the center pole we use a straight round pole 7 inches in diameter at the base and 5 inches at the top about 24

feet long. We put an iron band around the base and insert the peg upon which it turns. About halfway to the top is an iron collar, which has three loops to it that form an attachment for the braces, which are fastened about 15 feet from the bottom of the central pole. This allows the pole to turn readily when in upright position. The top framework is made of 2 x 6-inch pieces



HAY DERRICK

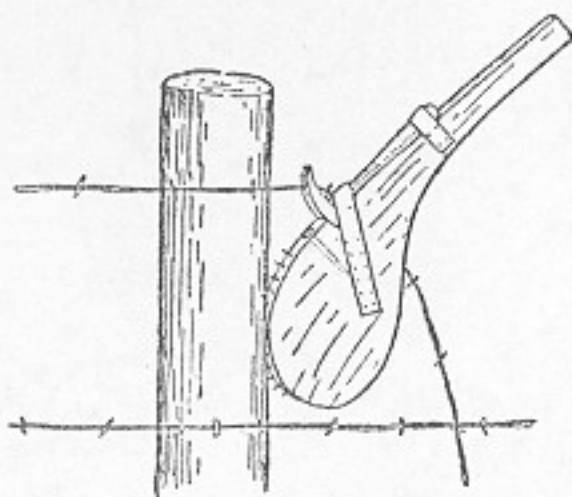
155

12 feet long. The rigging, consisting of three pulleys and the hay rope, is attached as shown in sketch. By having the lower pole attached near the base of the upright the arms will make half a turn when the hay fork is lifted, thus swinging around from the ground or wagon onto the stack.

A WIRE TIGHTENER

Here is a device easily made and very convenient to use in tightening barbed wire when stringing it

upon the posts. Cut out a piece of inch board in the shape shown in the picture with a notch to let in the face of a hammer. Insert a long bolt at the point indicated by the light dotted lines, to prevent splitting. Fasten on the hammer with leather straps. The sharp brads should stick out about half an inch. Carefully finish the handle so that it will be smooth and not hurt the hands when you are using the device. It should be made of tough hardwood.



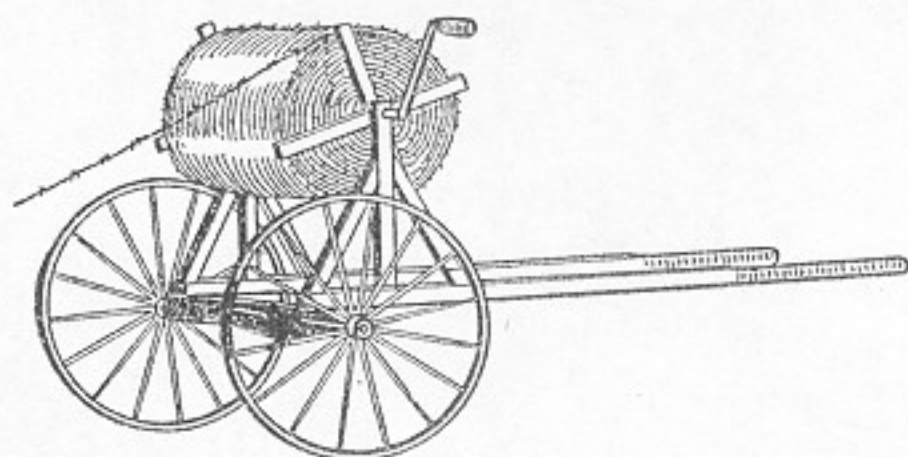
TIGHTENER IN USE

FENCE WIRE REEL

Here is a device on which one can wind barbed wire that is much better than an old barrel. The reel is mounted on a truck made of old buggy wheels with short shafts. The cart may be drawn

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along by a man while a boy steadies the reel to keep it from unwinding too rapidly. For winding up wire, the machine is best pushed just fast enough



WIRE REEL ON WHEELS

to keep up with the wire as it is being wound on the reel. A crank placed upon the reel proves serviceable in winding up.

SAFE WAY TO STRING BARBED WIRE

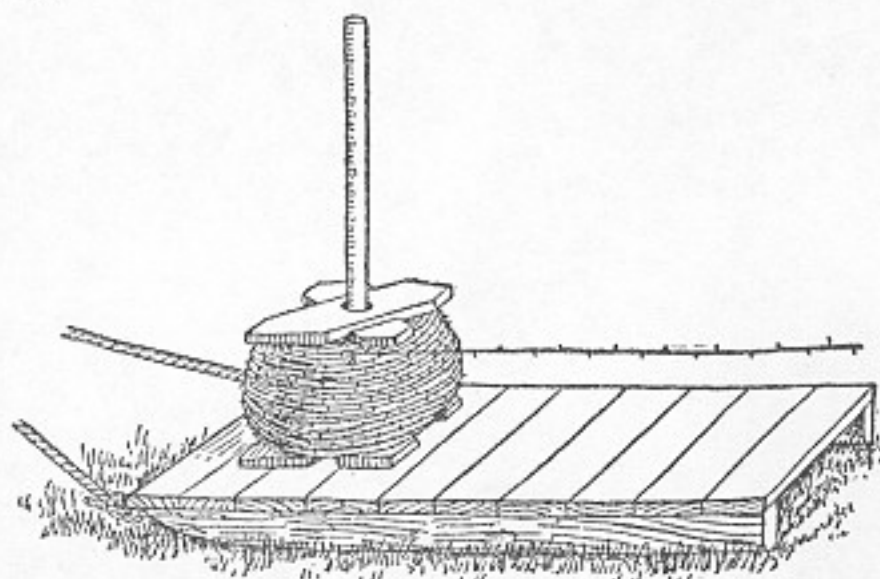
One of the most satisfactory ways to unreel barbed wire is to make a contrivance similar to the one shown on page 157. Fasten a short piece of plank to the front end of a stone boat. Bore a 2-inch hole in this plank and set the spool

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of barbed wire on top. Run a piece of gas pipe about 5 feet long through the spool and let the

bottom end rest in the hole made in the plank.

Attach the stone boat to the rear end of the wagon and have an assistant sit in the wagon and hold the top end of the pipe. If the wire becomes kinked the assistant simply lets go of the pipe and the spool rolls off the boat without breaking the wire.



WIRE REEL ON BOAT

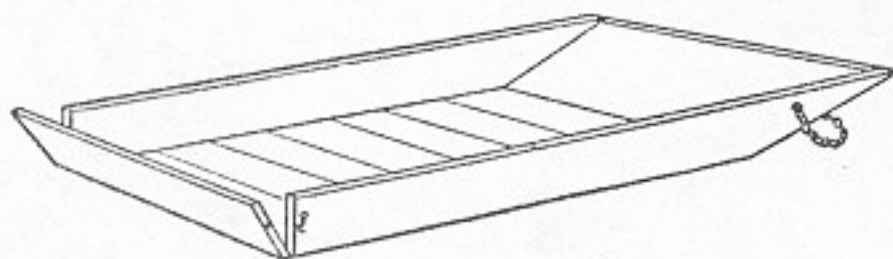
A BOXED STONE BOAT

A flat stone boat or drag is convenient for many purposes, but its uses are limited because it has no great capacity. On page 158 is shown an arrangement for increasing the utility of a stone boat 100 per cent. It is made of plank and has sides 1 foot high. It may be used for the purpose for which the ordinary drag is employed, and in addition is very convenient for hauling apples, potatoes, or other root crops from the field.

By increasing the size of the box, manure can be

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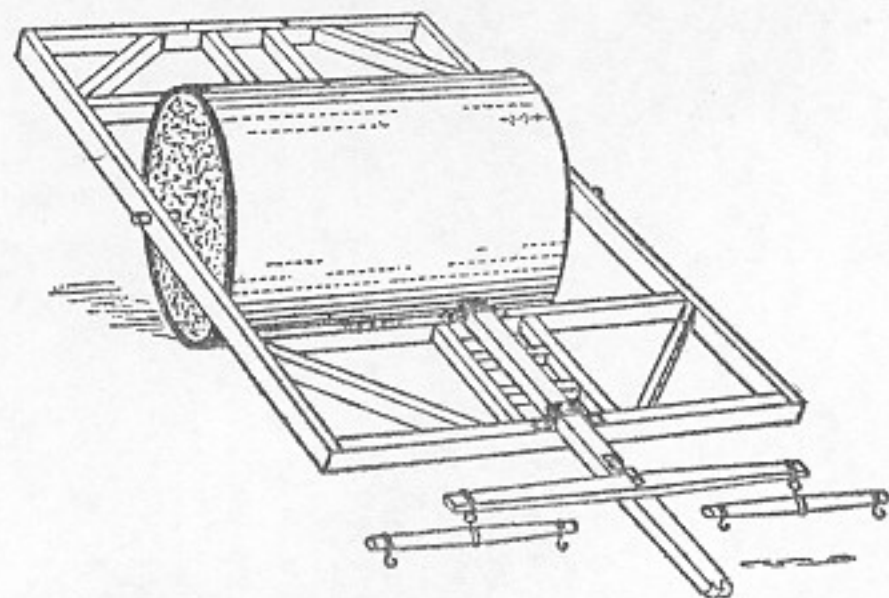
hauled out from stables as it is dumped into it from wheelbarrows without having to reload or wheel up an incline. It is low on the ground and very convenient for loading. All light, bulky articles, as well as heavy stones, bags of fertilizers and seed, can easily be hauled on this contrivance.



CAPACIOUS DRAG

A HOMEMADE ROAD ROLLER

If you need a road roller get a heavy sheet iron cylinder, stand it on end and place a length of 1½ or 2-inch pipe through the center. The end should be placed on planks which are well soaked or are



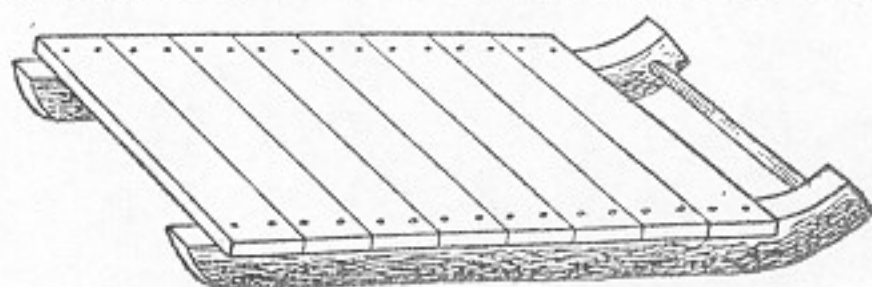
ROAD ROLLER

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well oiled, and the pipe braced to keep it exactly in the center. Fill the cylinder with good concrete, and when it has set tip it over and build a frame for it, so you can hitch a removable tongue at either side. The frame should be made of good strong hardwood well braced. The cuts show plainly just how the roller is made and put together.

AN OLD-FASHIONED DROGUE

Drogue is an old-fashioned word applied to a low drag or sled, something like the stone boat in general use now. The word is seldom heard today.



HOMEMADE HANDY DROGUE

So accustomed are we to the regulation stone boat that most of us do not know that there is still a more handy arrangement that is fully as easy to build and better to use, because it cannot slide sidewise on a hill. Select a small tree that has a bend in it the shape of a sled runner and split it with a sharp saw while it is green. It saws fastest and easiest while frozen. Saw or hew the bottom and top flat, so planks about 4 feet long may be pinned to it. Bore the front ends so a heavy stake with a shoulder may be inserted to prevent the runners from drawing together, and the drogue is done. It is handy for all work, but may need side rails spiked to it, if small stones are to be drawn.

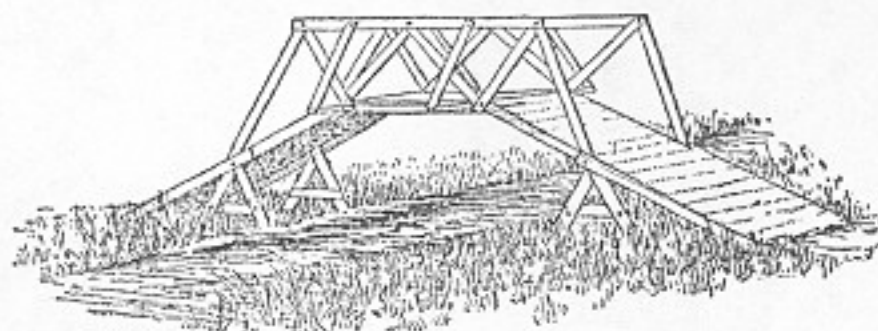
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Regular boat planks are not easy to obtain now that the old up and down saws are not in use.

There should be a ditching scraper on every farm. They can be purchased made of steel, but a homemade one costs little and is quite serviceable. Take two planks, each 10 inches wide and 3 feet long, of good 2-inch hardwood. Bolt to them securely a pair of old plow handles. To the bottom bolt an old crosscut saw blade which will make a sharp edge. Let this project about an inch at the bottom. Attach two singletree hooks near each end of the lower board and your scraper is ready to use. With this scraper and two men a ditch can be cut one-quarter mile long and as deep as it could be plowed with a turning plow in two days' time. It is also very useful in filling holes in the highway.

BRIDGE FOR A SMALL STREAM

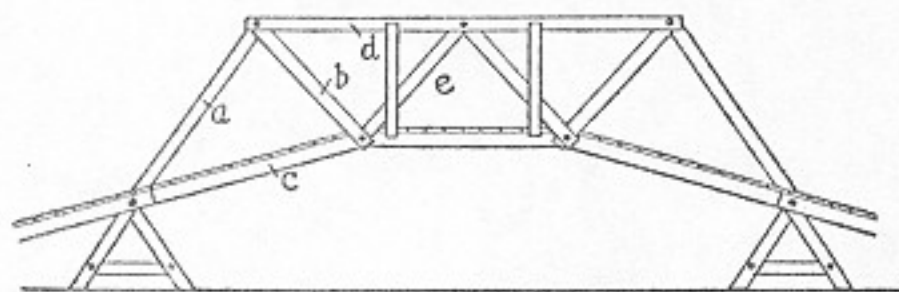
For crossing a small creek or deep ditch a cheap bridge can be built as shown in the illustration. The lumber used is 6 inches wide and 2 inches thick, except for the floor and four side braces.



A BRIDGE OF TRIANGLES

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Saw 11 pieces the length required for each of the two sides, then bore bolt holes $1\frac{1}{2}$ inches from each end. Use $\frac{5}{8}$ -inch bolts $8\frac{1}{2}$ inches long where four pieces come together and $6\frac{1}{2}$ -inch bolts where



FRAMEWORK OF BRIDGE

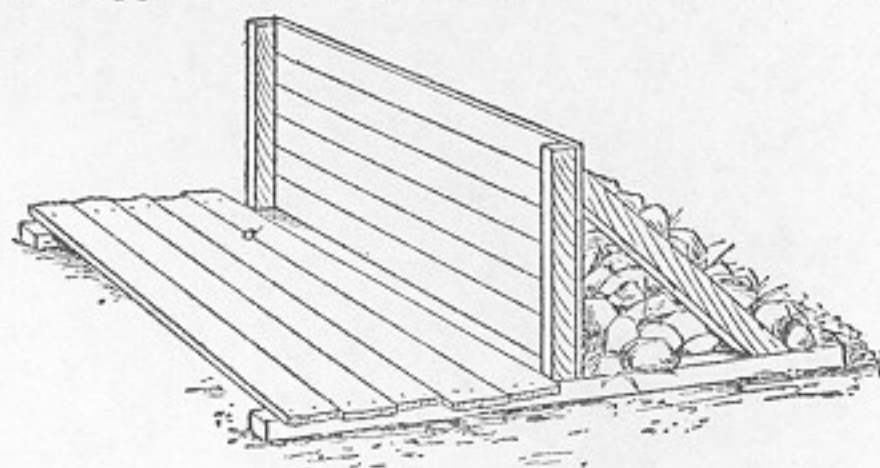
three pieces meet. The A-shaped supports and the pieces for the approaches are bolted on at once, and then the side braces are put on. The sides of the bridge are made entirely of triangles. The first triangle is made of pieces, *a*, *b* and *c*. The second triangle of the pieces, *b*, *d* and *e*. The piers may be posts, stone or concrete.

DAM FOR FARM POND

A small pond held by a good-sized hydraulic

dam supplies water for house, barn and two acres

gested for the length of the box. Any old wheels will do if they are not too heavy to be easily drawn by hand.

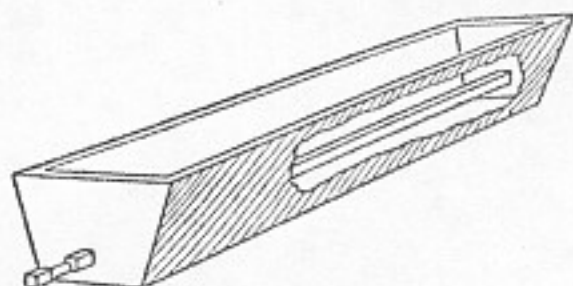


EASILY BUILT DAM
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of garden and fruit, also floods a cranberry meadow when needed. A section of the dam is placed 6 feet apart and covered with plank fitted tight. The apron is of 12-foot plank spiked to the sills so as to break joints. The bottom is made tight with brush and clay. Stones are piled in behind the plank coverings, as shown in cut.

SOWING SEED EVENLY

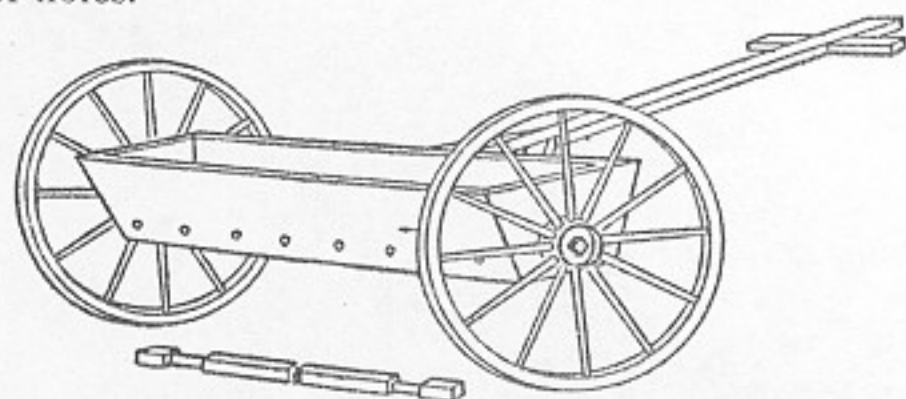
These drawings show the construction of a wheel seeding device that can be easily made at home.



THE SEED BOX

The axle is tightly fitted into the wheels so that it turns when the wheels do. This agitates the grain or other seed and helps to keep the seed running out of the holes at the lower back side of the box. The quantity of flow may be regulated at pleasure by making the holes large or small and increasing or diminishing the number of holes.

The axle is tightly fitted into the wheels so that it turns when the wheels do. This agitates the grain or other seed and helps to keep the seed running out of the holes at the lower back side of the box. The quantity of flow may be regulated at pleasure by making the holes large or small and increasing or diminishing the number of holes.

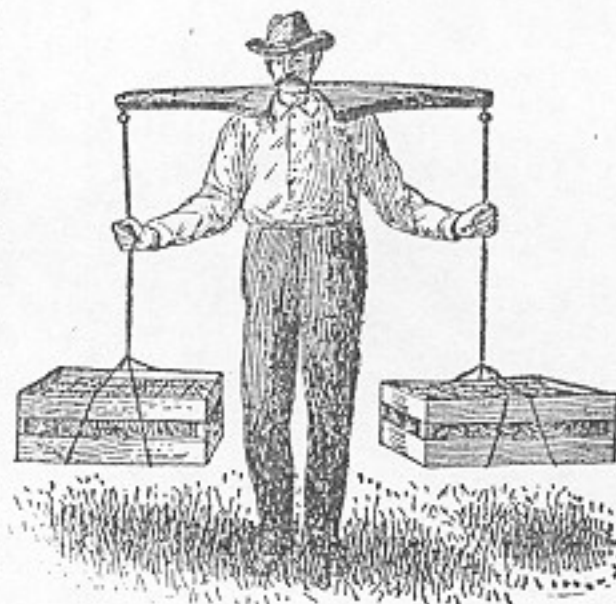


A SOWING MACHINE
163

It may be found desirable to have a considerable number of holes and then having plugs, for alternate ones, perhaps, which may be removed to make the seeding thicker. From 4 to 6 feet is sug-

BERRY CRATE CARRIER

One of the most convenient appliances for use in the strawberry field is illustrated in the picture shown herewith. It shows a novel use for the old-fashioned yoke used so commonly on the old-time farms. The picture is so readily understood that no description need be given. This also suggests the many purposes for which a yoke may be used on a farm. Every farmer ought to have one, to make more easy the task of carrying things. In



YOKE CRATE CARRIER

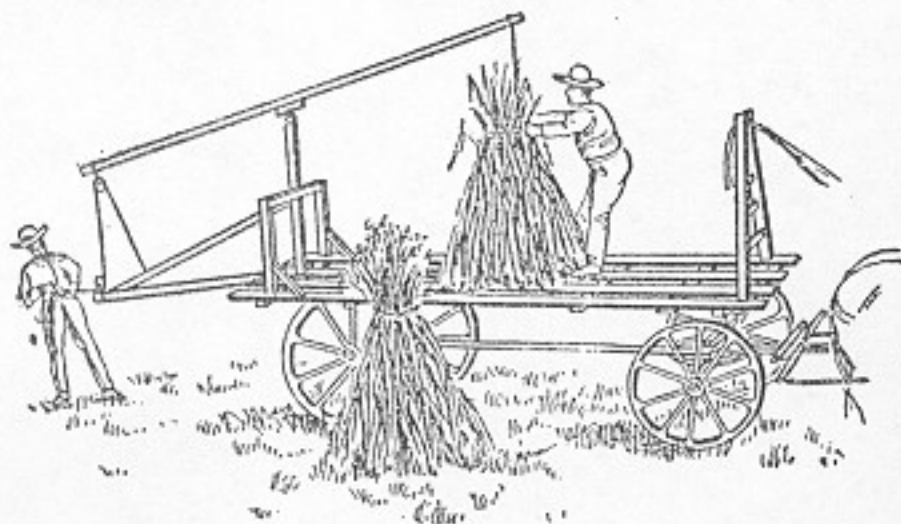
some places yokes may be found for sale, but if you cannot buy one, make one yourself. Take a piece of strong, tough wood, shape it out to fit around the neck and shoulders and taper off the ends to what you consider the right size. Usually a groove is cut around about 1½ inches from each end and

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a rope is securely tied. At the other end of the rope a hook is attached the right size to go around the bail handle of any ordinary pail. The hook may be iron or may be formed from a strong, branched stick.

HANDY LOADING DEVICE

Here is a rig simple and strong that works well for loading corn in the field. The picture shows



LOADING RIG IN USE

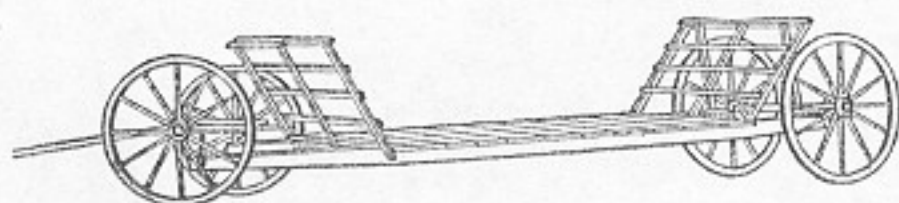
the construction of the rack and hoisting device with pulley attachment. Such a rig will be found useful for loading many things on a farm.

RACK FOR HAULING FODDER

A handy rack for hauling fodder from the field is shown in the drawing. It may be used for any kind of corn, of course, for sorghum, and may be found useful in moving brush. Each end of the

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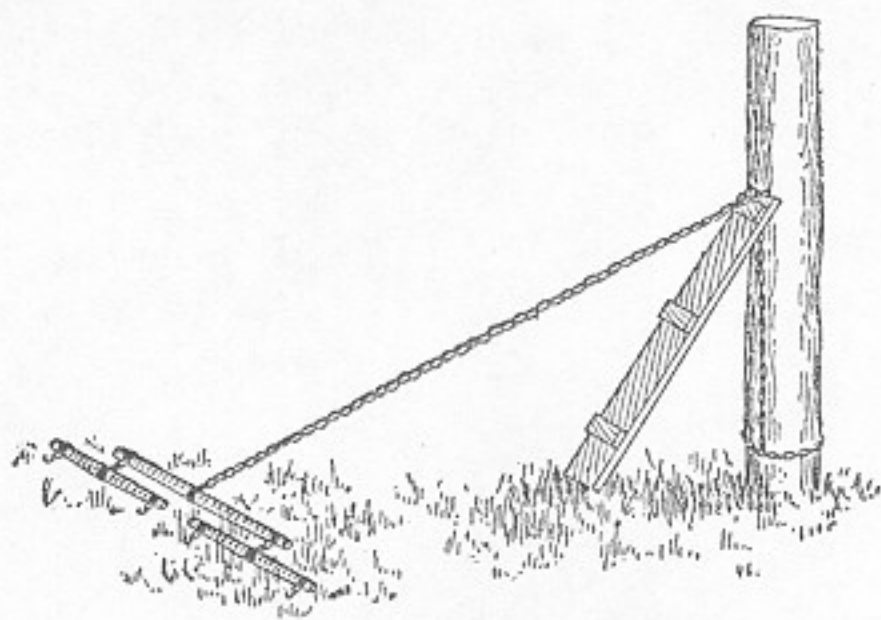
rack is hung from the axles by two straps of iron that can be obtained from any blacksmith at very little expense.



FODDER RACK

PULLING FENCE POSTS

An easy and practical method of pulling fence posts, by which all digging and hand labor is eliminated, is here shown. Take a plank 4 feet long,



POST PULLER IN POSITION

1 foot wide and make a V-shaped notch in one end, nailing on several crosspieces to prevent splitting. This plank is used to change the horizontal draft to the vertical.

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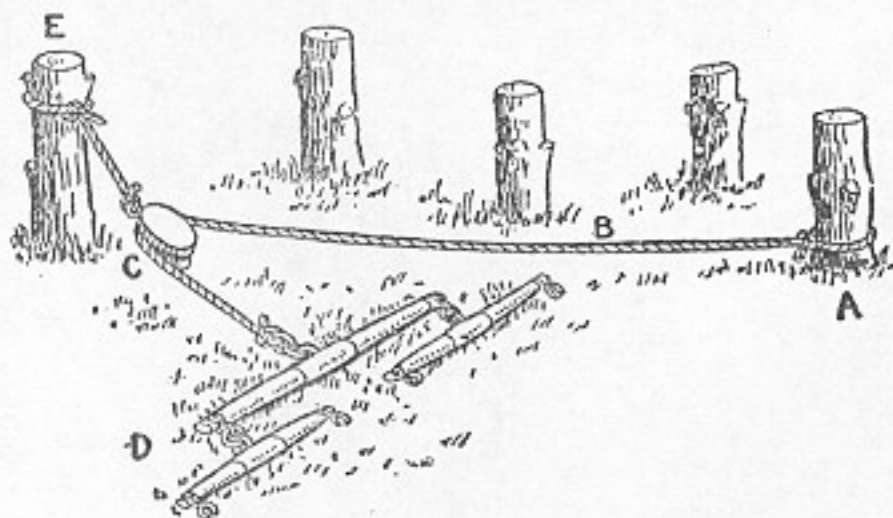
Place one end of chain around the post close to ground. Incline the plank against the post so the lower end of the plank will be about 1½ or 2 feet from the base of the post. Place the chain in the notch of the plank, start the team and the post in a few seconds will be clear of the ground.

In moving fences the chain should be attached to the rear axle of the wagon, so the posts may at

once be loaded and hauled to the new location of the fence.

ONE WAY TO PULL STUMPS

A Connecticut man has a very handy device for pulling peach stumps from old orchards, and can



TACKLE FOR STUMP-PULLING

pull 200 or more a day by this means. The limbs are cut off and the stumps, E, left as long as possible. A short rope or chain with a single pulley is attached to the top of the stump. The anchor rope, B, which runs through the pulley, is fastened to the bottom of a stout stump, A.

A pair of steady horses is attached to the rope and always pull toward the anchor stump. With

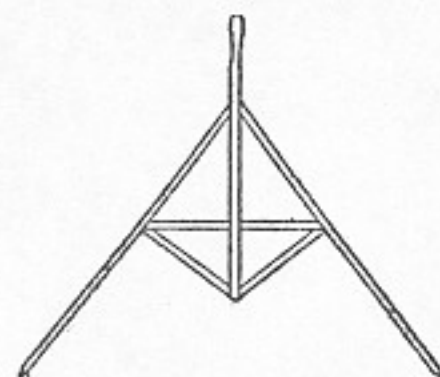
167

a steady pull there is no jumping or jerking, and they will walk right off as if pulling a loaded wagon. Use about 60 feet of 1-inch rope, which costs \$2.40, and the pulley, \$1.75, making a total cost of \$4.15.

SIMPLE LAND MEASURE

Having much land measuring to do that requires greater accuracy than just "stepping it off," make a simple affair like this.

The manner of construction is made plain. Use hardwood pieces; ⅝ or ¾ x 1 inch is heavy enough. Have lower points exactly 5 feet 6 inches apart. Make a round head on the handle. Grasp the top lightly in hand, holding at the side, whirl handle to bring rear point to front, moving off in direction to be measured. Continue to revolve measure, changing points in advancing. It takes three lengths to the rod.



THE MEASURE

STORING WATER

An easy way to make a reservoir at the spring

is to throw up a bank, perhaps laying a wall first, founding it below the surface. Should the soil be such that water percolates through it, face the soil with loam on top and puddle it well. If this leaks, face it with clay and puddle the clay. These rules apply to all dams made of stone and earth.

Pipes entering reservoirs should enter at the bottom and the soil be well puddled around them

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to prevent the water working through beside the pipe. Each pipe must have a strainer over its supply end and have no air holes in its entire length.

A good strainer can be made from a piece of large lead pipe punched full of holes. One end may be flattened or turned over and the other drawn on over the end of the water pipe. Let nobody suppose that simple, inexpensive arrangements are faulty because primitive. If constructed correctly and in line with natural laws, they are not only all right, but are preferable to fancy, complicated devices that get out of order easily or in a year or two and require a master mechanic to put them into working condition again.

GETTING A SUPPLY OF FUEL



A PLAN for getting up the year's supply of fuel is suggested as follows: Fell the trees on the ground with a small sapling under them, so a log chain can be passed beneath. Then a logging bob

(Figure 1) is tipped up on its side near the end of the log; a chain is hooked to the bolster near the ground, passed under the log and over the top runner of the bob and the team hitched to the end of the chain. A quick pull of the team and the bob comes down on both runners, with the log on the top of the bolster.

The log is now drawn to some sheltered place near the woodhouse and sawed into stove lengths with a 6-inch crosscut saw on the skidway shown in Figure 2. The limbs are trimmed in the woods, drawn on a pair of bobs to the shop, where there

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is a three-horse power boiler and two-horse power engine, and are sawed at the rate of $1\frac{1}{2}$ cords an hour with a buzz saw. A handy device can be made of two crotched limbs, as shown in Figure 3, to saw large limbs on. A 2-inch auger hole is bored where the limbs branch, and a hardwood limb driven tightly into the hole.

The following described device (Figure 4) is very handy to hold and lower the tree after sawing

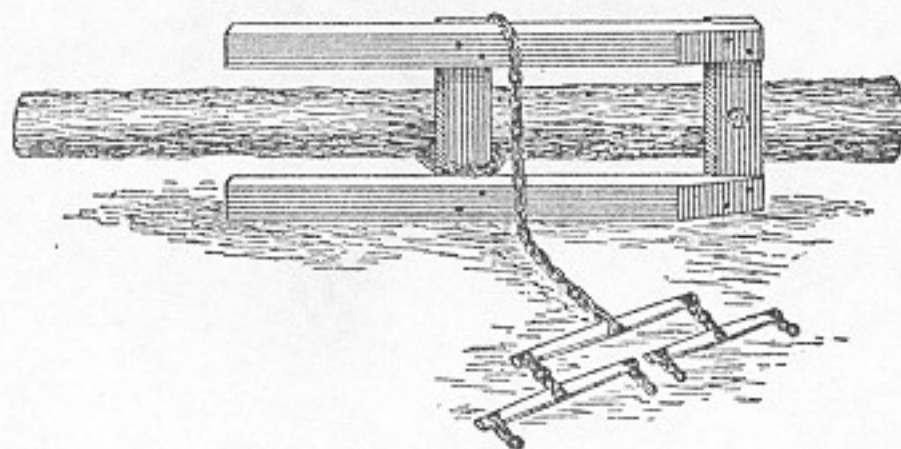


FIGURE 1—LOGGING BOB

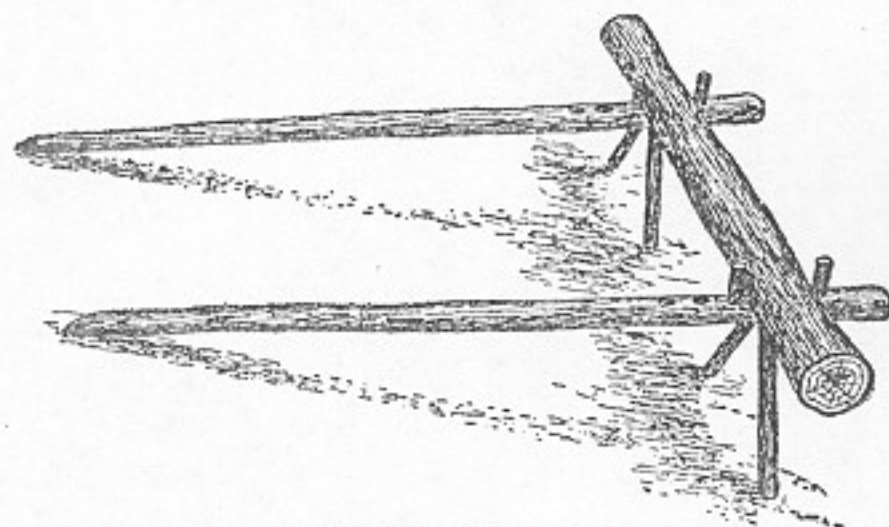


FIGURE 2—SKIDWAY

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the stump off. [*a*, planks with holes bored in them; *b*, log; *c*, chain; *d*, crotched limb; *ee*, lever; *f*, iron pins.] It is made of two hardwood planks about 8 x 5 inches and $1\frac{1}{2}$ inches thick bolted together at the top and bottom, with a 2-inch space between

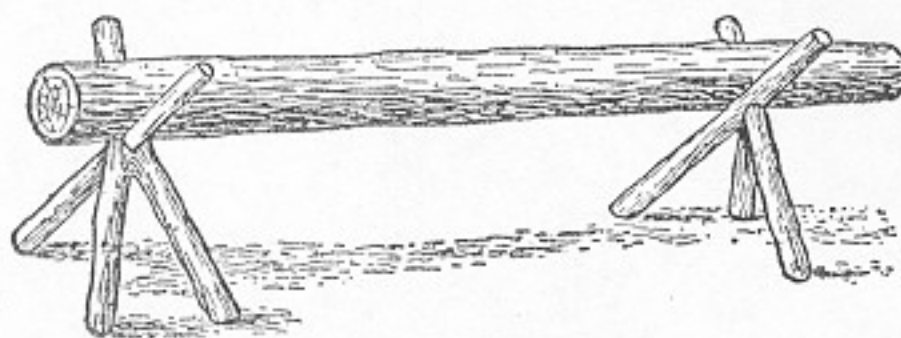


FIGURE 3—HANDY SAWHORSE

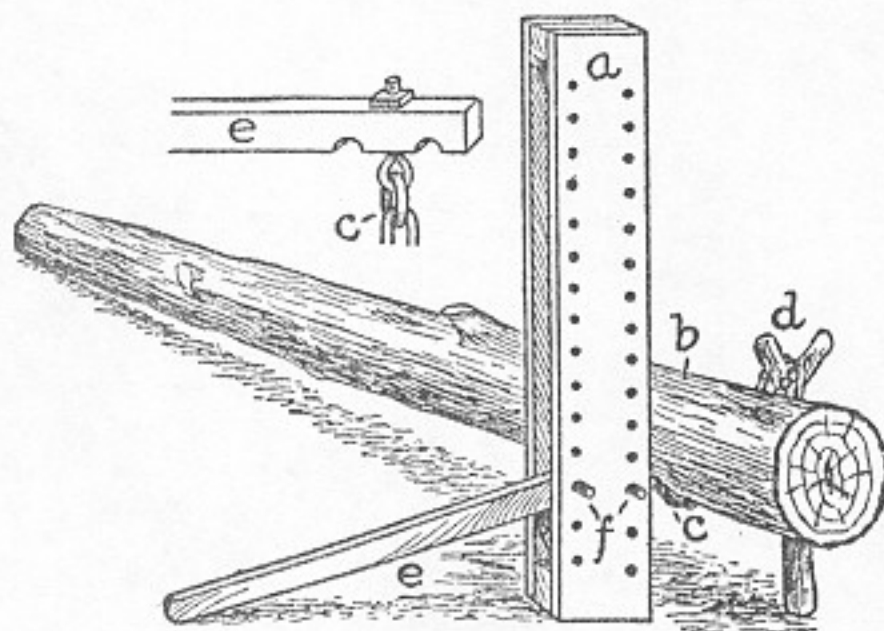


FIGURE 4—LOG JACK

for the lever to work in. One-inch holes are bored through the sides of both planks, in which iron pins are placed for the lever to pry over. The lever is made of white ash, and has two notches near the large end, with a chain link attached midway be-

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tween notches. A stout chain is hooked in the link, passed under the log, and attached to a crotched limb leaning slightly against the opposite side of the log. By working the small end of the lever up and down and moving the pins up one hole at a time, a good-sized tree can be raised from the ground high enough to be sawed easily without a backache.

SIMPLEST OF ALL CAMPING TENTS

The great trouble with camping-out tents is the weight of the frame, but the weight of the latter in



Fig 1

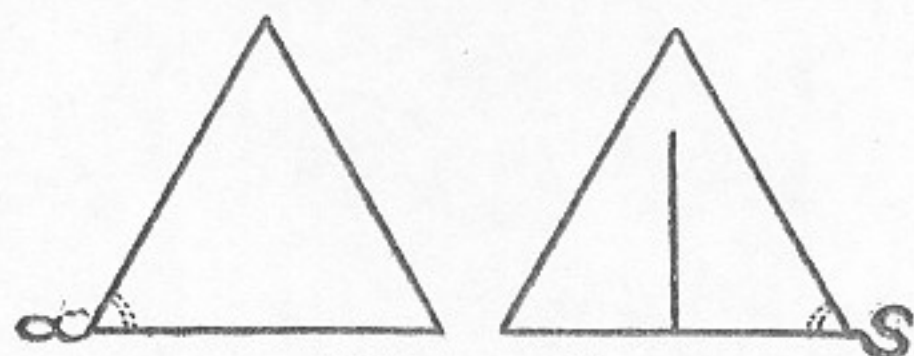


Fig 2

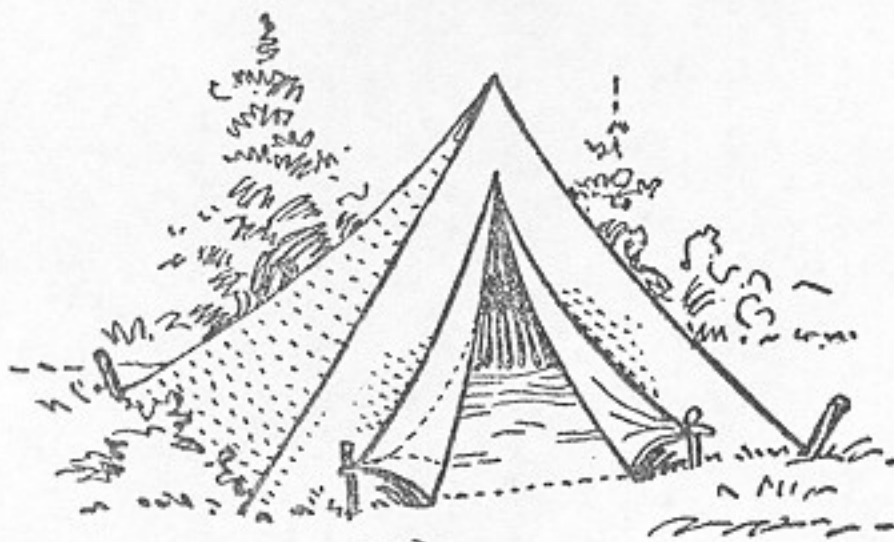
DETAILS OF TENT

the case of the tent figured herewith will hardly prove a burden to anyone, as only two light sticks are used, such as are shown in Figure 1. These

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are pressed into the ground 8 or 10 feet apart, according to the size of the tent, and brought together and fastened at the upper ends with such a joint as is shown, or with a string passing through a screw-eye in each pole, if a simpler method is preferred.

The tent is made from four triangular pieces of cloth, as suggested in Figure 2. One of these is cut up the center and hemmed, to afford an entrance to the tent. The triangular pieces are sewed together at the edges and at two of the opposite corners pieces of stout cord are sewed into the corners of the cloth, the cloth being reinforced as



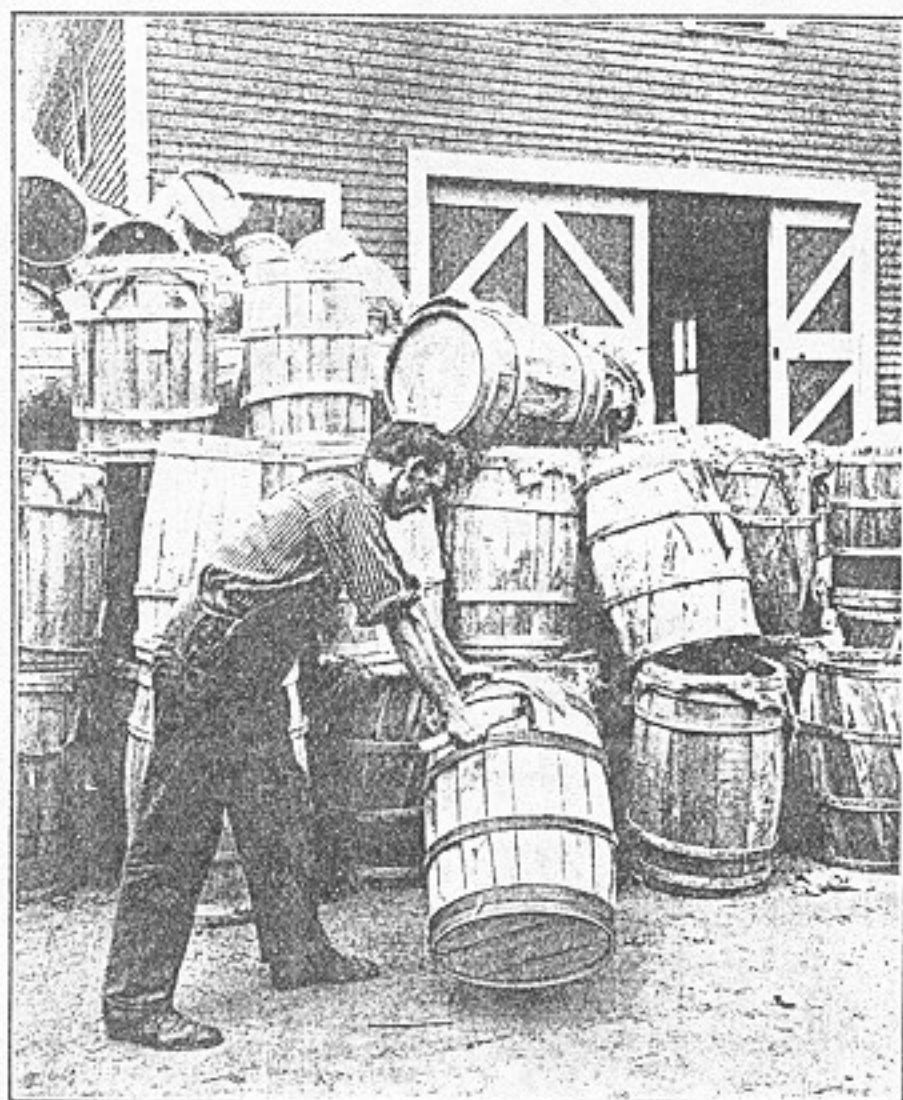
THE TENT SET UP

suggested in the cut.

Two stout pegs of wood and two lighter ones are provided. To pitch the tent, put up the two frame poles A-fashion and draw the tent cloth over them, opposite seams and corners fitting over the poles. Draw out the other two corners and tie by the ropes to the stout pegs which have been driven into the ground. The two lighter pegs are

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used to fasten back the flaps of the front. It may be found well to hem a light cord into the bottom of the side having the opening, leaving the flaps free from the cord. The position of the cord is



SAVE THE BARRELS

Barrels, barrel hoops and barrel staves may be worked into many useful things upon a farm. From the few described in this book your ingenuity will lead you to others.

shown by the dotted line. It will not be in the way when lying across the opening of the tent on the ground and will strengthen the whole when the outer corners are drawn tightly up to the stout pegs.

This makes a practically square tent and the size can be as large or small as may be desired. To cut the side pieces, decide on the width of the sides and the height you wish the tent to be. Then draw a triangle (Figure 2), having the base as long as desired for the side of the tent, and a perpendicular 2 feet longer than the height desired for the tent, since the four sides of the tent are to be inclined, and must, therefore, be enough longer to make up for this.

This will prove a very satisfactory tent for boys who are camping out, and it has the merit of being easily made and very easy to carry about.

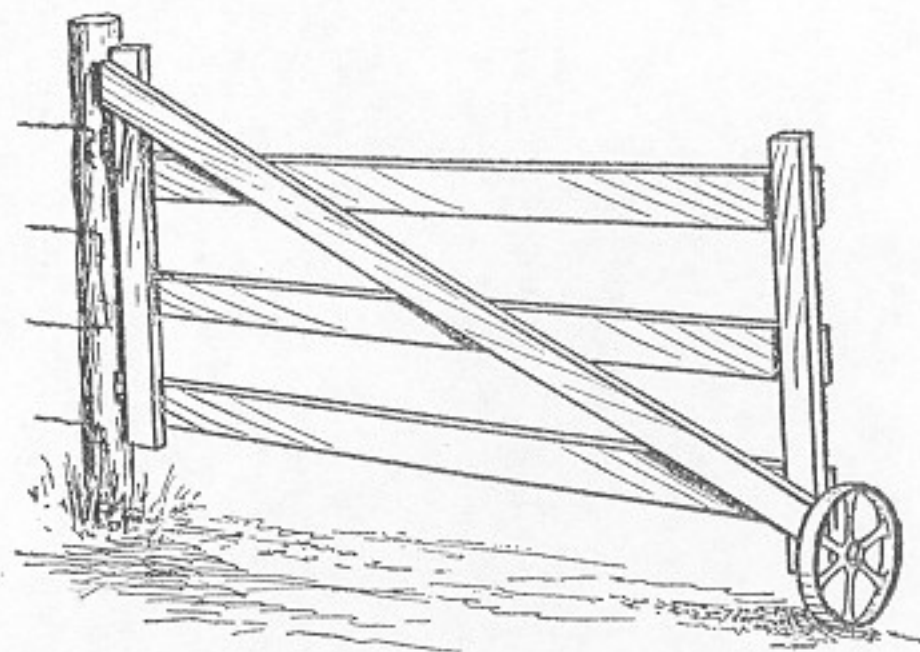
174



KEEPING A GATE FROM SAGGING



THE average farm gate is heavy, and after a little time it sags. When they get this way it takes a strong man to open and shut one. Here is a remedy. Get a wheel, either big or little, from an old piece of machinery, and bolt it to the front end of the gate in such a way that the gate will be held level. Now the smallest child can open



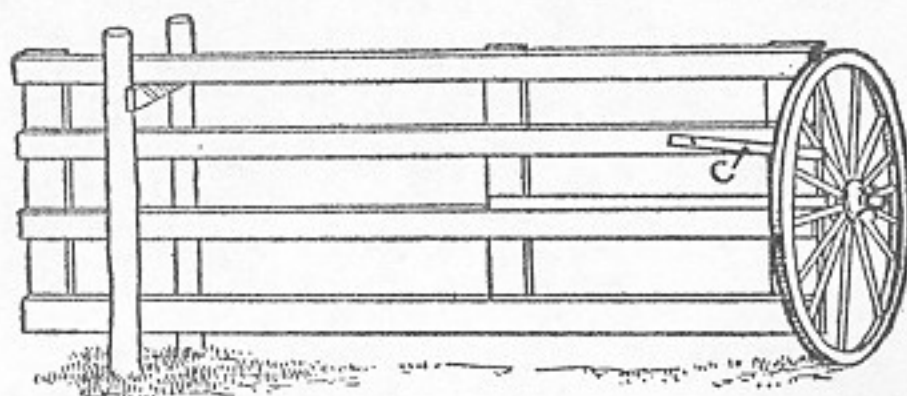
OLD PLOW WHEEL DOES THE TRICK

the gate for you. Try it, for it is a saver—saves your patience, your back and the gate.

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AN EASILY OPENED GATE

Take an old buggy wheel and fasten it as shown in the drawing to the gates that are opened often. The piece of board indicated by *c* drops between

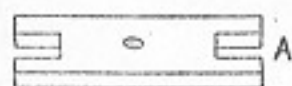


GOOD USE FOR A WHEEL

the spokes of the wheel and holds the gate either open or closed. A child can easily operate the heaviest gate with this attachment.

A GATE THAT NEVER SAGS

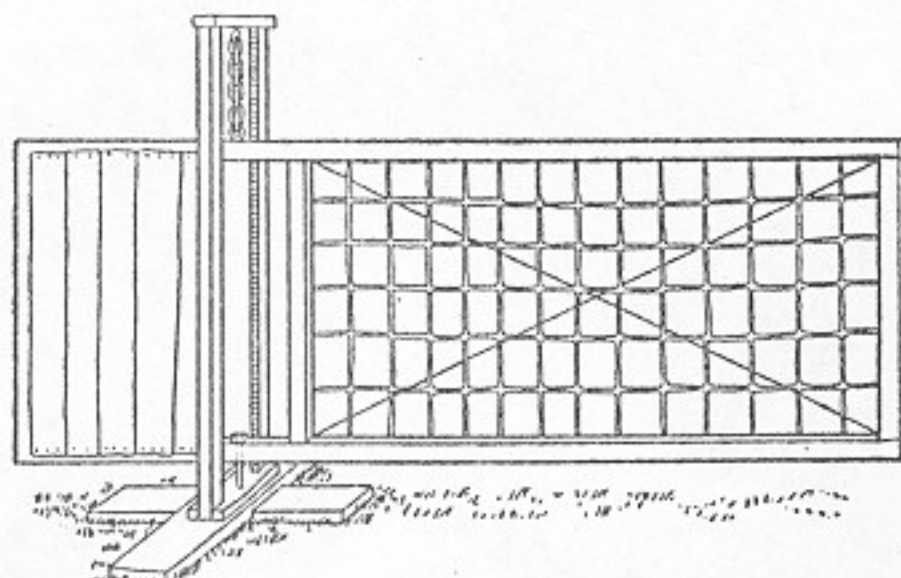
A farmer has used this gate for many years and never spent five minutes repairing it. Countersink



CROSSPIECE

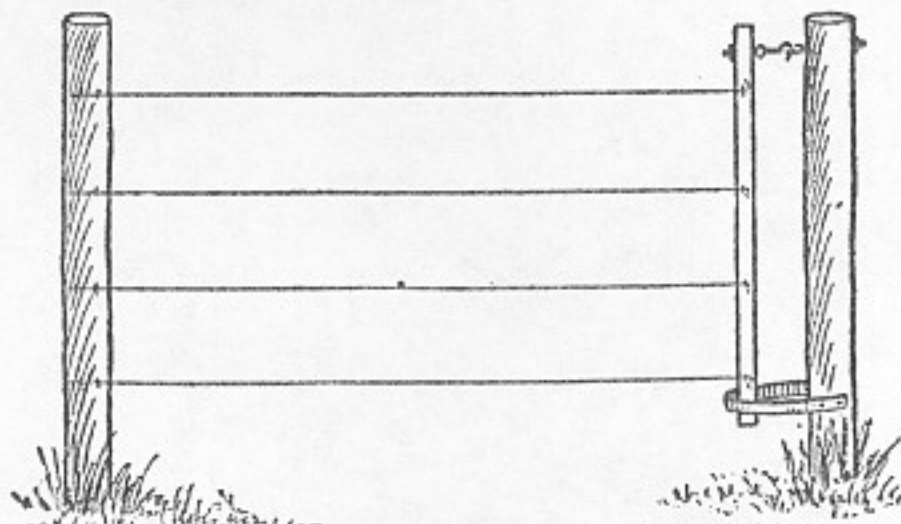
two pieces and pin them together. Then set up two 2 x 4 pieces 2 feet higher than the gate so it can be raised in winter. Mortise and set in between the crosspieces, which are 12 inches apart, the board, *a*, and fasten a cap to the top of the frame. The gate is 16 feet long, 12 feet being for the gateway and 4 feet for the weights to balance it. The frame is of 2 x 4s. Cover the 4-foot end with boards and fill with enough stones to balance it when hung.

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BALANCED WIRE GATE

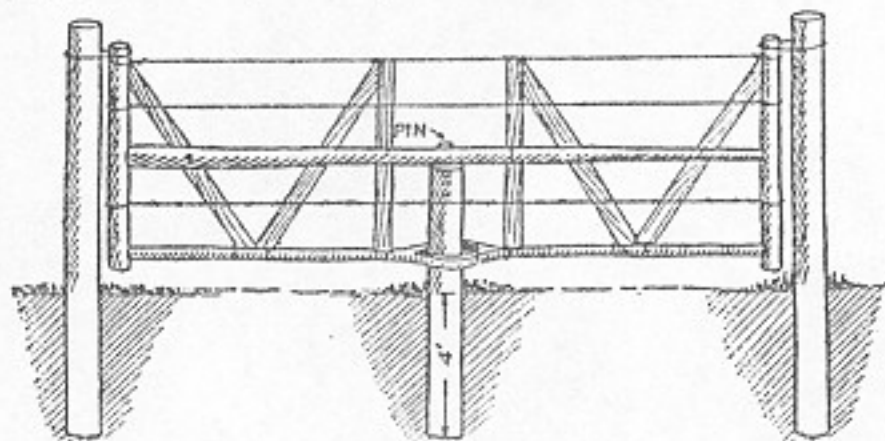
Cover the gate with wire fencing and hang by a chain. Put a bolt through the lower part of the



WIRE GATE THAT SPEAKS FOR ITSELF

A CHEAP GATE

A light, useful and durable gate can be made of sassafras poles and barbed wire, as shown in the cut. Set a strong post 4 feet in the ground in the middle of the gateway and balance the gate on it.

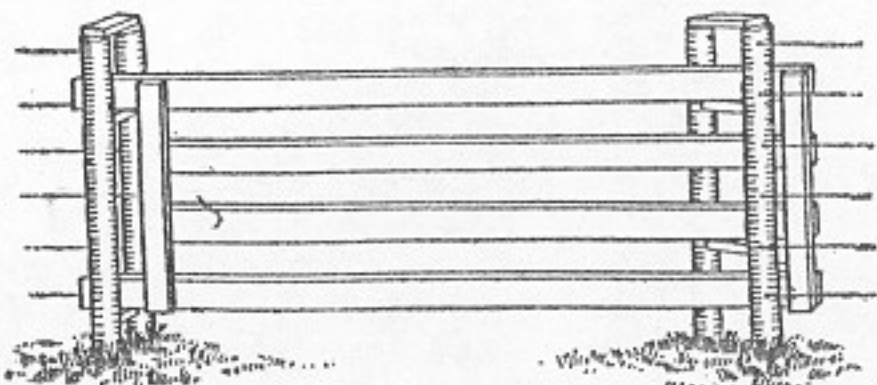


POLE AND WIRE GATE

The lower rail is made of two forked sassafras poles securely nailed together so as to work around the post.

A SIMPLE FARM GATE

Many like such a gate as that shown in the cut. Material to be used depends largely on the purpose for which the gate is made. For a paddock or pasture gate, make it out of seasoned boards 1 x 6 inches, 12 or 14 feet long. The posts supporting



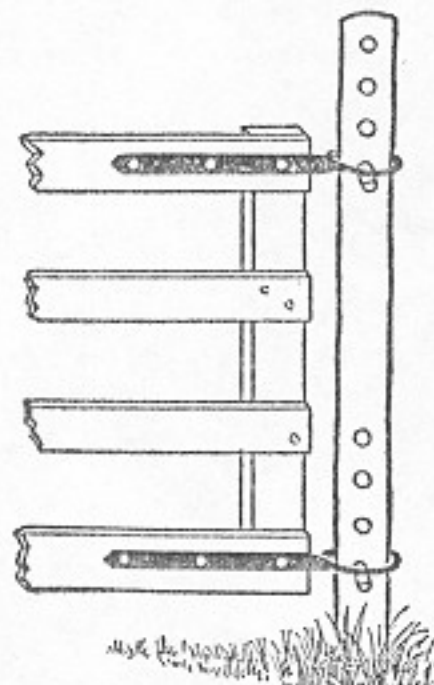
GATE SIMPLE AND STRONG

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the gate are about 5 inches apart, the one on the inside being about 8 inches ahead of the other. They are joined together by cleats or rollers which support the gate and allow it to be pushed back and swing open. If rollers are not obtainable, cleats made of any hard wood are good. They need not be heavier than 1 x 4 inches. If the gate is to be used for a hog pasture, the lower cleats on both sets of posts should be placed just above the lower board to prevent the hogs from lifting it up.

AN EASILY REGULATED GATE

The gate hanger illustrated in the drawing is very handy for use where it is desired to let hogs



ADJUSTABLE HANGER

pass from one pasture to another while cows are confined to one. As shown, the hanger is a piece of strap iron bent around the post and supported by pegs. These pegs may be inserted in holes at varying heights. Raise the gate to let the hogs through and lower it to keep them in, of course. This is also a good device for raising the gate above the snow in winter. Many would find this use of the adjustable hanger preferable

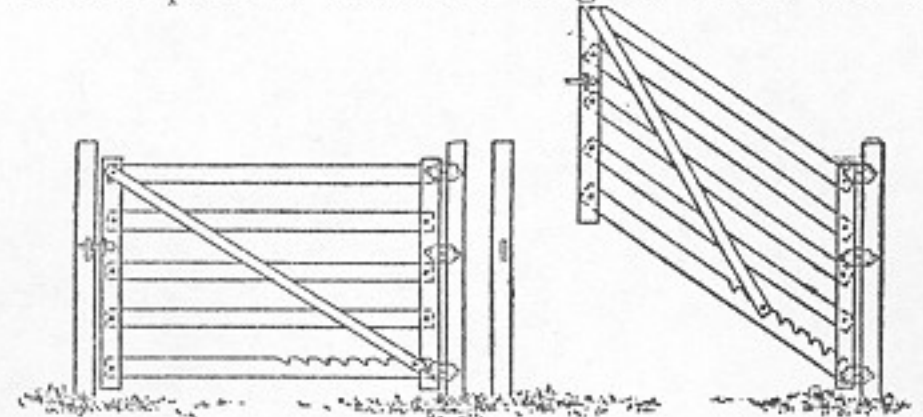
to the gates made to raise only one end for snow. Of course it is desirable that there should be the least play as possible while the hanger

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slides up and down freely, and special care should be taken to set the post firmly. Otherwise the gate would sag.

GATE TO OVERCOME SNOWDRIFTS

In the picture is shown a gate which can be

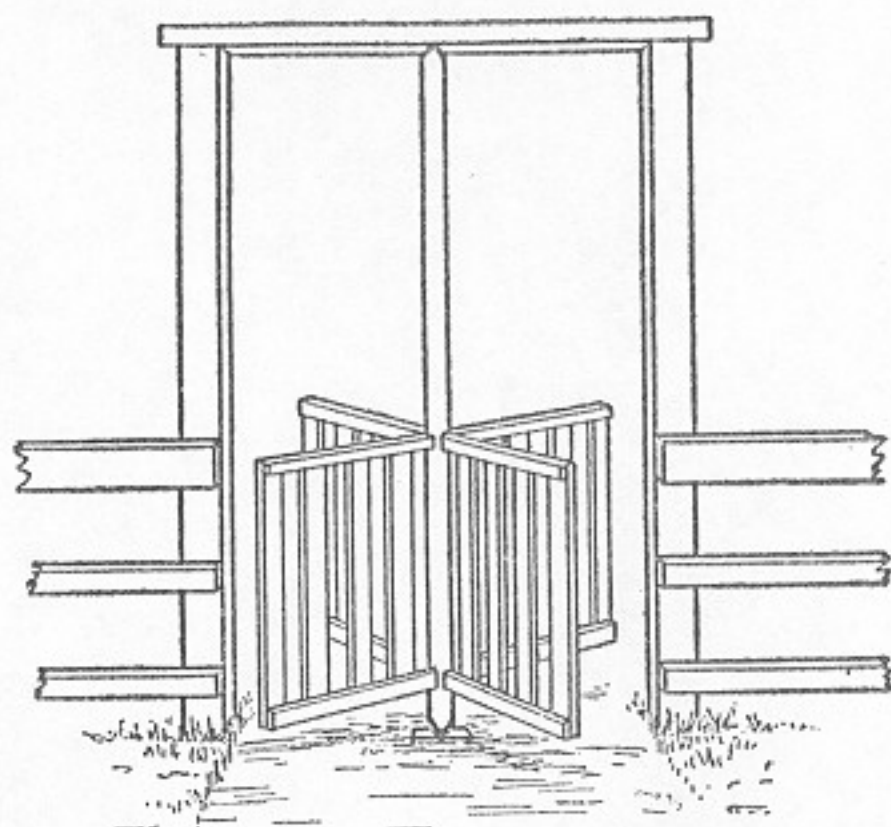


GATE SHUT AND OPEN

readily adjusted to swing over snowdrifts. It is easily made from ordinary lumber. A 1 x 6-inch upright is used for the lower boards, 1 x 4 for the upper ones. The uprights at the hinge post are double 1 x 4, one piece outside and the other inside the bars. The upright at the latch side may be the same weight of stuff or slightly lighter, and fastened in the same way. Instead of nailing the bars to these uprights, bolts are used, one for each bar at each end. The lowest board is notched as shown, and the double brace used from the top of the latch post to the bottom of the hinge post. For the brace, 1 x 3 stuff is strong enough. They are joined near the bottom with a bolt, which engages with the notches when the gate is raised, as shown at the right.

180 A TIME SAVER

To open and close gates that stock may be kept within bounds the year round is one thing which uses up a great deal of time, and makes no return. Every gate should be so made that it will fall into



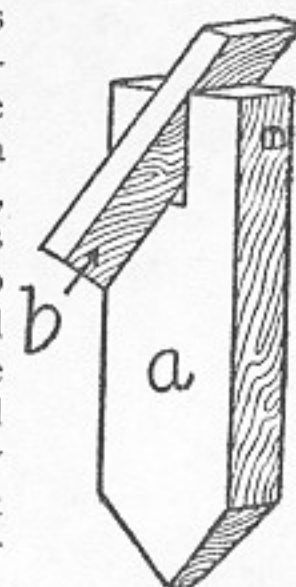
TURNSTILE GATE

place of its own weight and stay closed and open without hitch or bother. The cut illustrates a convenient thing that should be in larger use on farms. It is always open and always closed against stock. Put up and well painted, it will last for many years.

181 KEEP THE GATE OPEN

A simple and handy device which serves to hold the gate open is shown in the cut. To make it,

procure a board, *a*, 1 x 4 x 12 inches and saw out a portion in the center, leaving a space on each side $\frac{1}{2}$ inch wide, and bore holes for a bolt. Next get an 8-inch stick, *b*, and bore a hole through it 3 inches from the top. Bevel the top so that the gate will pass over it, and it will then fall back and hold the gate open. When one's hands and arms are full of things, as they often are on a farm, it is a great convenience to have a gate or door held open automatically. No simpler or more effective device for the purpose can be found. A similar device can be adapted to use as a latch to catch and keep a gate or door closed.



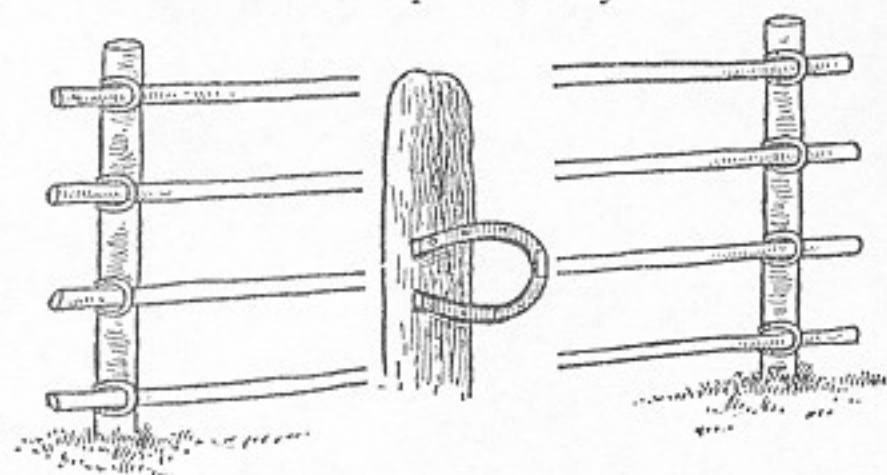
GATE CATCH

GOOD BARS FOR THE FARM

It is an important matter to the farmer that his farm should be well equipped with good, substantial bars. Some farmers go to as much trouble in a year's time in moving a poor gate or bars back and forth as they drive in and out of fields, and in chasing cattle about, as making dozens of such bars as are represented here. Use round poles about $2\frac{1}{2}$ or 3 inches in diameter. Set two good-sized posts one on either side of the barway, and to each one, an equal distance apart, nail large horseshoes, al-

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lowing the round part to stand out far enough from posts to admit the bar poles easily.



BAR WITH HORSESHOE CATCH

DURABLE FLOATING FENCE

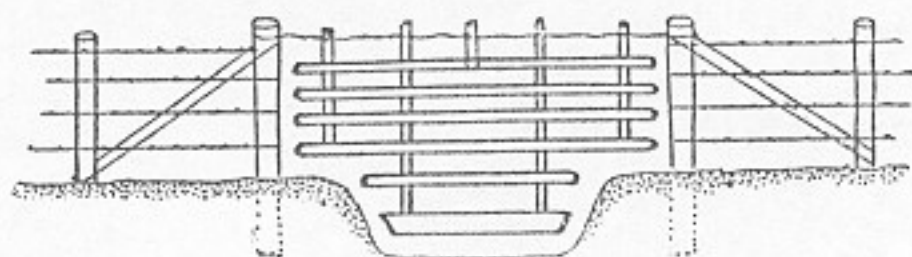
This is a cheap and easy way to make a good, strong cable on which to hang a water gate, when it becomes necessary to have a fence cross a stream: Set two good, large posts about 3 feet deep in the ground and about 6 feet from the banks of the

stream. Get a piece of wire (barbed wire will do, but smooth wire makes a much better looking job), long enough to go from one post around the other and back again about six times, being careful to fasten each end securely at the proper height from the ground. Then get a strong piece of wood about 1 x 3 inches and about 4 feet long, stand as near the middle of the space between the two posts as possible, and place the stick between the two sets of wires. Turn around until all the wires are well twisted together, being careful not to twist too much.

On withdrawing the stick, the wires will only untwist two or three times. After the gate is hung, the stick may be again inserted in the same place

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and several more twists given to take up the sag caused by the weight of the gate. Then fasten one end of the stick to the top of gate and it will be im-



SUSPENDED GATE

possible for the cable to untwist any more. This has been found to answer all the purposes of an expensive cable and looks and lasts just as well.

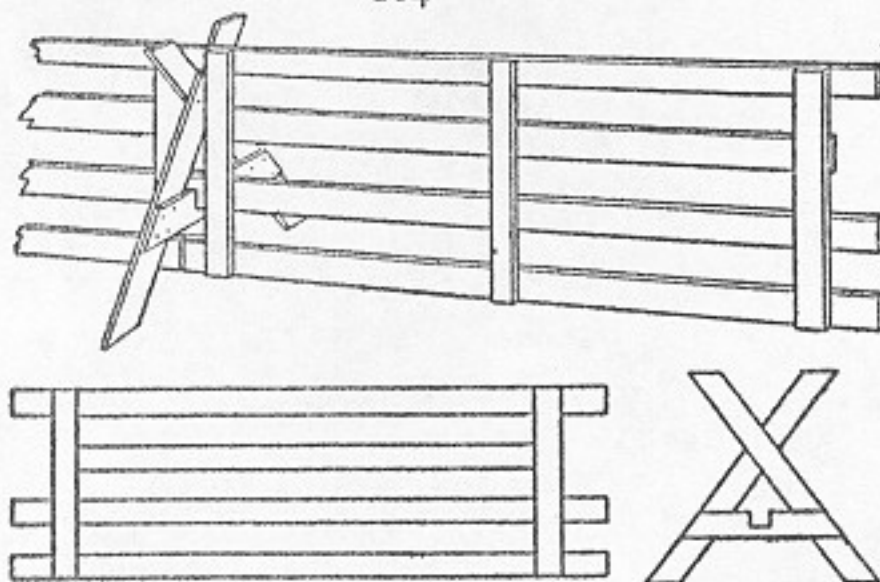
FENCE ACROSS A STREAM

To construct a fence across a creek or small stream, set a post on each bank and brace well. If a tree happens to be near at the right place, so much the better. Then fasten wire securely on posts, leaving enough slack so a weight in the middle will draw the wires toward the bed of the stream, thus making it impossible for stock of any size to get through. A large stone makes a good weight. It can be blocked up to desired height and fastened in position with smooth wire.

TEMPORARY SHEEP FENCE

One of the best portable fences for use in soiling sheep is made in panels with supports, as shown on next page. Panels are 10 feet long, made of 4-inch board solidly nailed together. After this fence is once put up, sheep are not likely to overturn it. A fence 3½ feet high will turn most flocks.

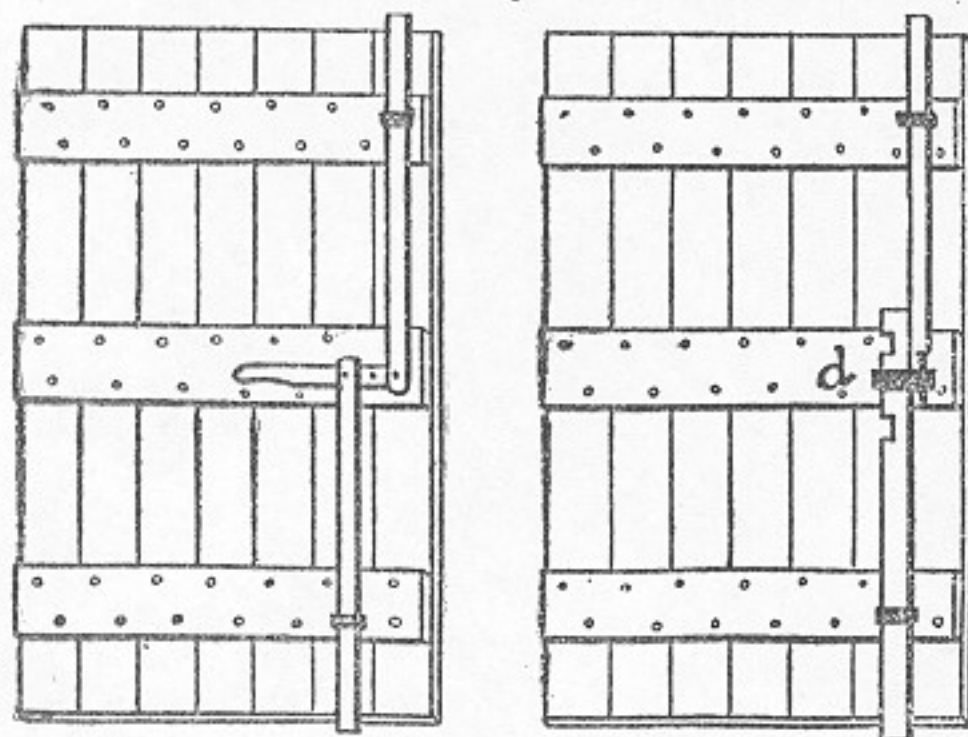
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MOVABLE FENCE AND PARTS

FASTENING HEAVY DOORS

There is little difference in the effectiveness of these two locks for heavy doors. The left-hand



TWO BIG DOOR LOCKS

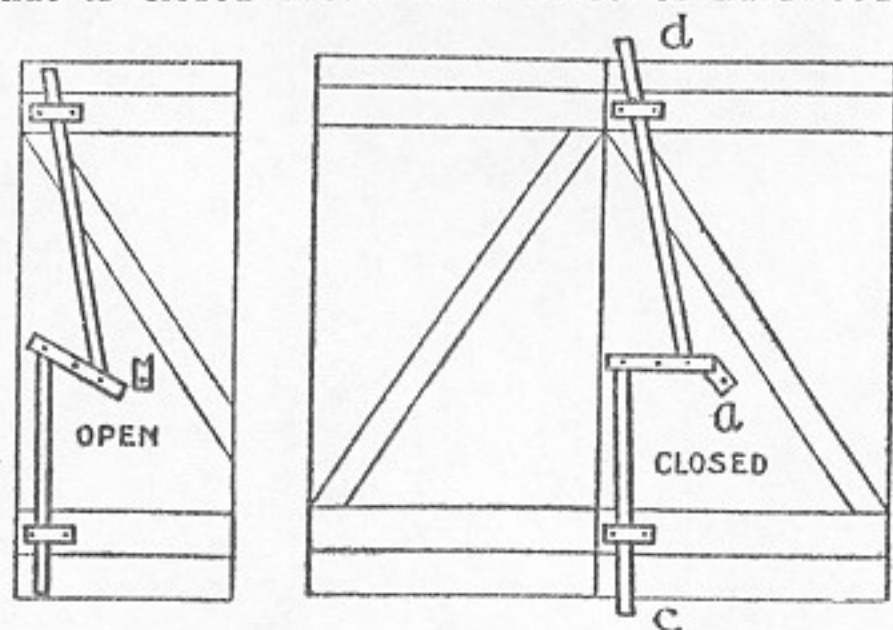
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device is extremely quick and handy; the other very neat and substantial. The lock to the left has both bars pivoted to a lever handle, which is pivoted to the door midway between the ends of the arms. Moving the lever handle up moves both arms out of slots above and below the doors. The fastening may be also worked from the inside by cutting a slot through the door and setting a pin in one of the arms, so that it can be moved in the slot.

The right-hand fastening is worked by raising the lower arm so that the notch incloses the middle staple at *d*. Then the upper arm can be pulled down. Both arms stay firm and snug whether the door is shut or open.

HOLD THE BARN DOORS SHUT

A latch that will hold double doors shut is shown in the cut. This is put on the inside of the door that is closed first. It is made of hardwood 4



LATCH FOR DOUBLE DOORS

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inches wide and 1 inch thick. To open the door, turn the piece, *a*, to the right and pull down on the crosspiece which is fastened to the door by a bolt in the middle. This will raise the latch, *c*, and lower the latch, *d*, as shown in the cut to the right.

FASTENING THE STABLE DOOR

A handy stall door fastener is shown in Figure 1. It consists of a piece of oak or other hard wood

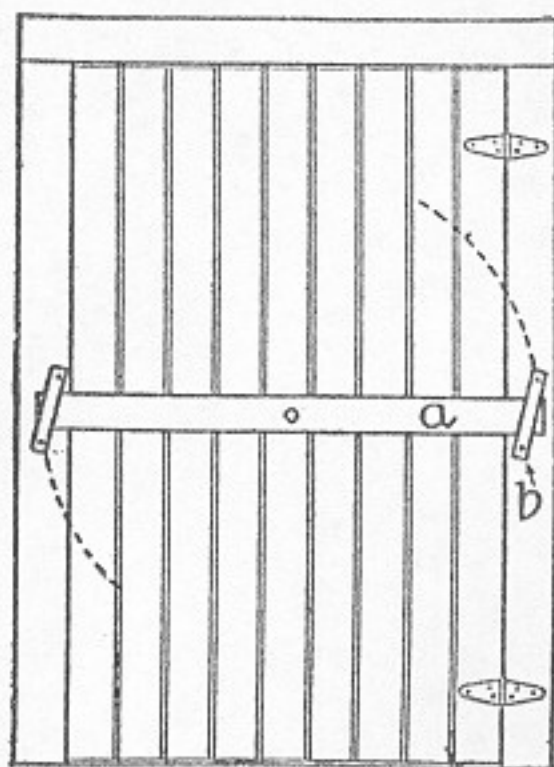


FIGURE 1—LONG FASTENER

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There are three upright pieces, *a*, two of which are on the door and one on the door jamb or casings.

4 inches wide by $\frac{7}{8}$ inch thick and 2 inches longer than the width of the door. It is fastened to the door by a $\frac{3}{8}$ -inch bolt through the middle and it works like a button. Cleats, *b*, are sawed out and fastened to the door jamb on each side to hold the fastener in place.

Another handy fastener that can be worked from either side of the door is shown in Figure 2.

Another piece, *b*, slides through these and holds the door shut. A pin, *c*, goes through the bolt and through the door to open or shut it from the opposite side. The bolt is kept shut by the spring, which can be made from a piece of hickory, or other tough hardwood, whittled down to the proper thickness. The spring feature is the chief advantage, and a

very important one it is, of this excellent fastener. It is also a good point that the fastener works nicely from the opposite side of the door.

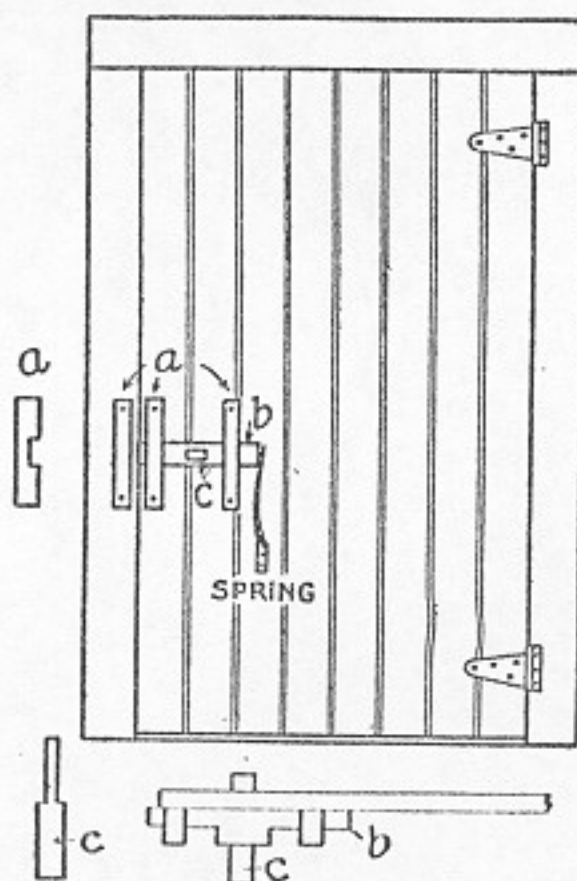
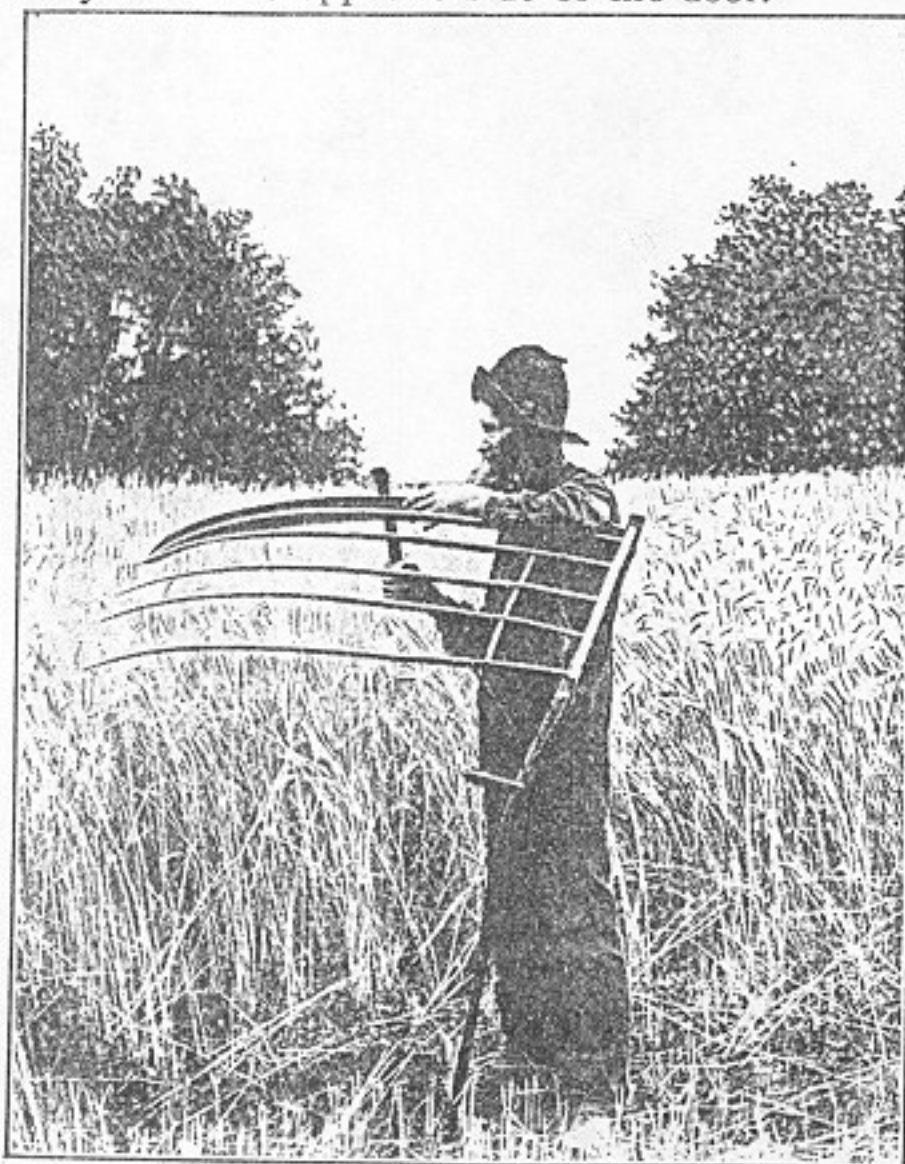


FIGURE 2—SPRING FASTENER



AS IN DAYS OF YORE

Modern harvesting machinery has come to take the place of old-time hand tools on the big farms; but many a reaper of the ancient type still swings through the golden grain, a relic of the days when men worked harder and accomplished less than they do today.

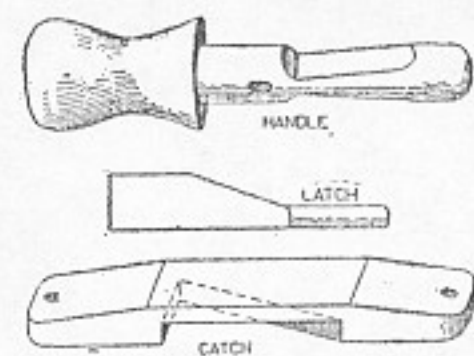
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HOMEMADE DOOR LATCH

This consists of three pieces of oak or other good hardwood, as shown in the drawing. For

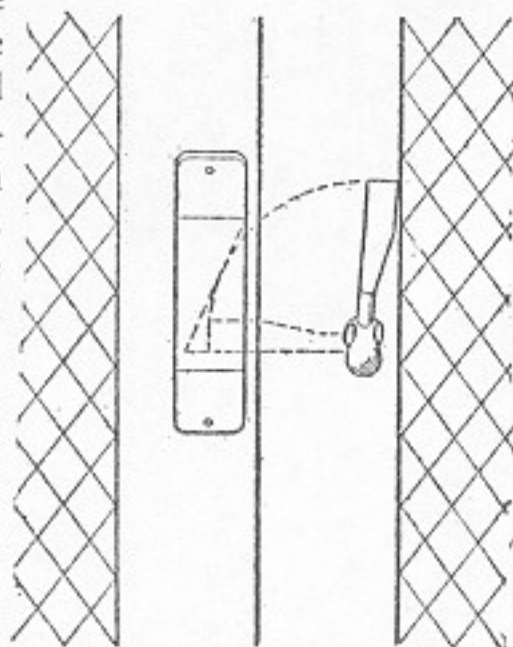
the handle use a piece 8 x 2 x 1 inches. Shape a flattish knob on one end 3 inches long. Work down the rest so as to pass through a 1-inch auger hole. Shape a knob on the other end by flattening the sides.

The latch is made of a piece 5 x 1 x $\frac{3}{8}$ inches. The catch is 8 x 2 x $\frac{3}{4}$ inches. Bore a 1-inch hole for the handle 3 inches



DETAILS OF LATCH

from the edge of the door. Push the handle through the hole and mark on it the thickness of the door; then bore in the handle a $\frac{3}{8}$ -inch hole for the latch. Now assemble the parts according to the finished figure, which shows the latch thrown back. A little peg may be used to keep the latch from falling down when the door is open. By taking pains to shape and finish this latch nicely it will look well enough to please the artistic eye of the most fastidious.



LATCH IN PLACE

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IMPORTANT POINTS IN HOUSE BUILDING



THE following points in building a house are considered of the greatest importance by a well-known architect: Carefully watch that the foundation walls are substantially laid, and accurately leveled on their upper surfaces, so that the doors shall not strike the floor or carpets in opening, nor the tables, chairs, or other furniture be obliged to stand on three legs.

The framework, when raised, should be plumb, agricultural editors. It is 34 feet wide by 30½ feet so that all on or in the building can be cut square, deep, with a 7-foot cellar underneath. The house

and applied without tedious fitting. The siding should be thoroughly seasoned in the open air before using, and carefully applied with close joints, and well nailed. The edges of all water tables, corner boards, and window frames should be painted before setting.

The shingles should be carefully laid, breaking their joints at one-third of their width and double nailed. The flooring should be dry, close laid, and nailed with two nails to each beam. The partitions should be set with studding of selected width, and their angles or corners should be anchored firmly together to prevent the walls from cracking in those parts when finished. The chimneys should be carefully constructed, all points between the brickwork should be well filled with mortar to prevent sparks from passing through to the framework.

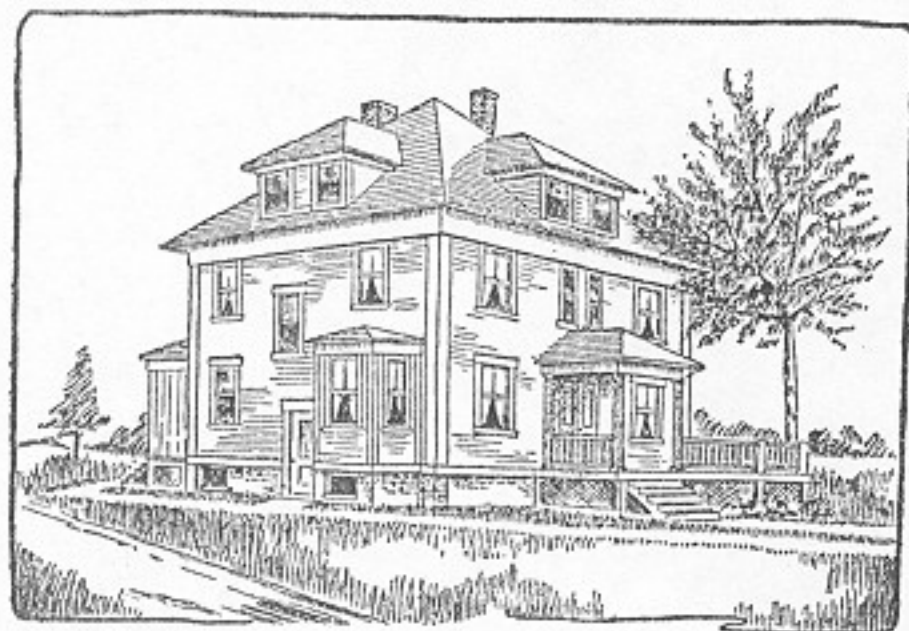
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All mortar for plastering should be properly mixed, and allowed sufficient time (at least a week) for the thorough slacking of the lime, and a complete permeation of the caustic properties. Thin coats of plastering are better than heavy ones. A mortar that does not crack in setting or drying is sure to be good.

The interior wood finish should not be begun until the plastering is completely dried out, and all loose mortar is removed from the building. All woodwork usually painted should be primed as soon as in position.

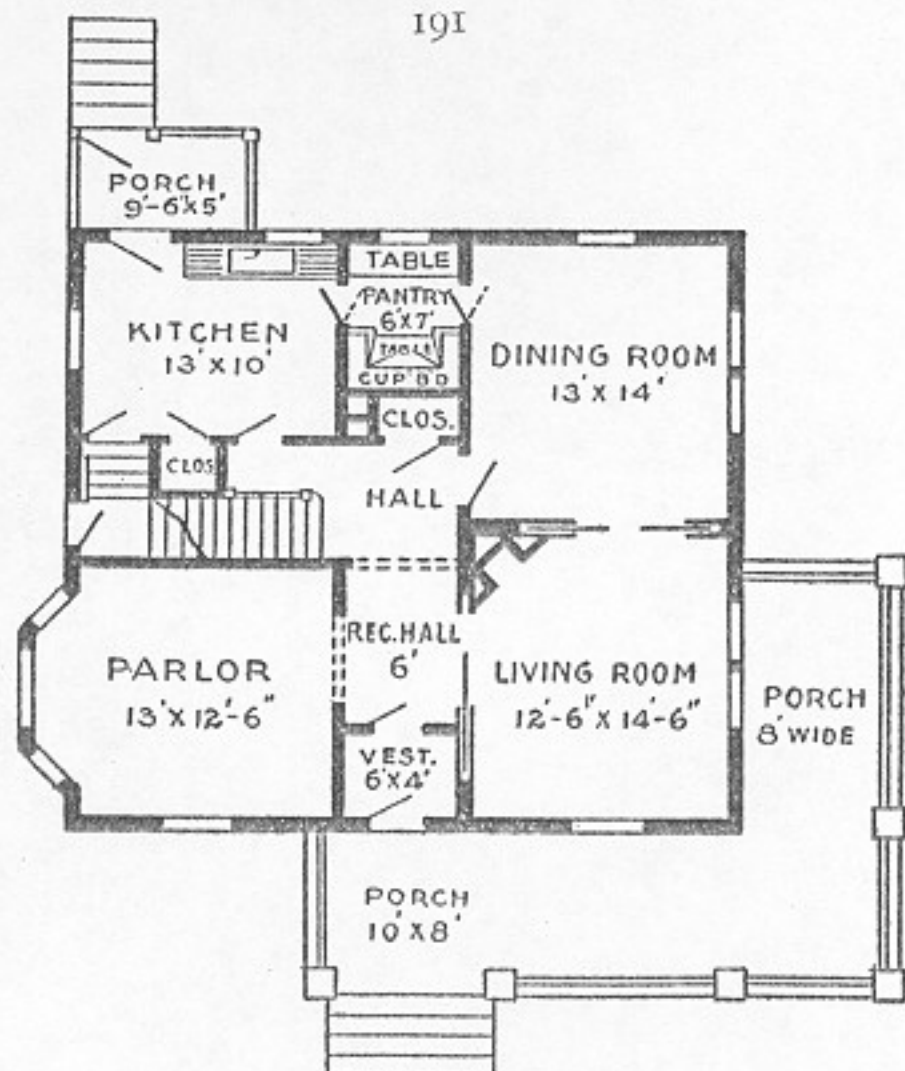
A VERY CONVENIENT HOUSE

The accompanying picture and plans show the outside and interior arrangements of a very convenient home built the past year by one of our



AN ATTRACTIVE HOME

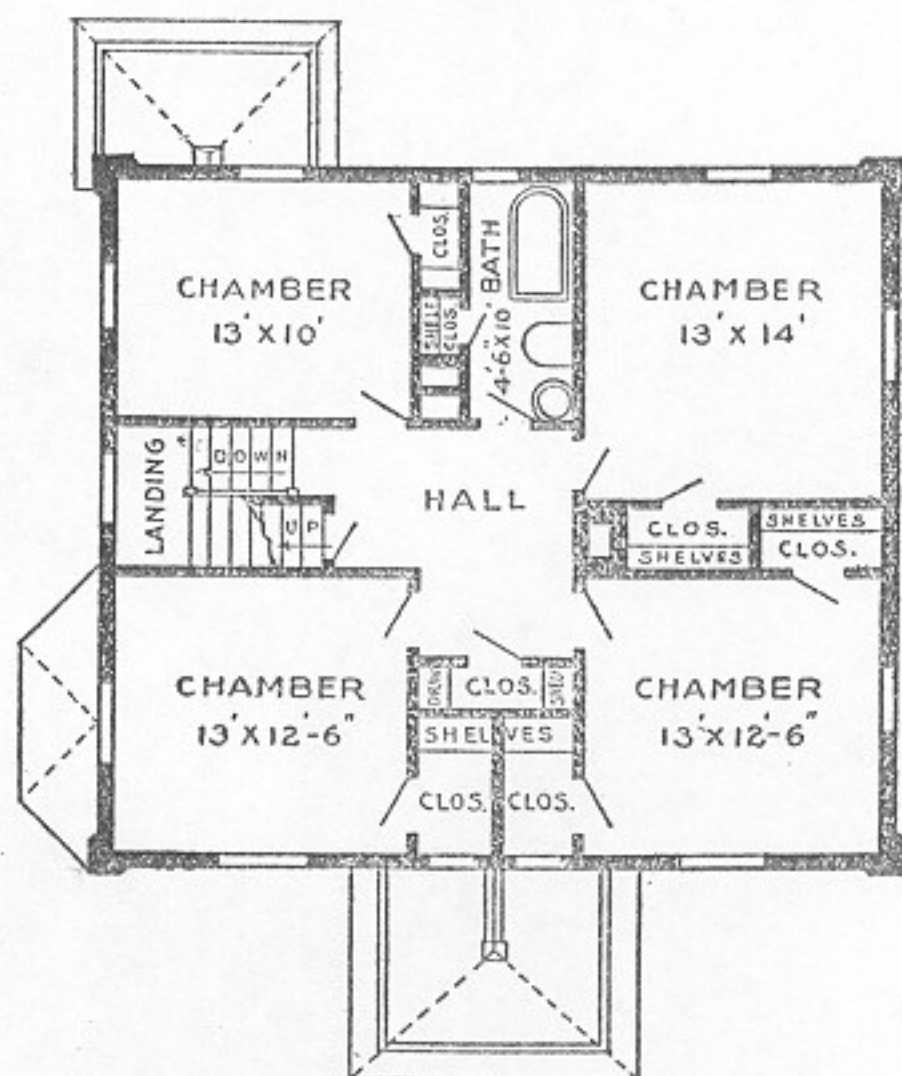
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PLAN OF FIRST FLOOR

contains 10 rooms, including two in the attic, besides a storeroom in addition to those shown. All

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PLAN OF SECOND FLOOR

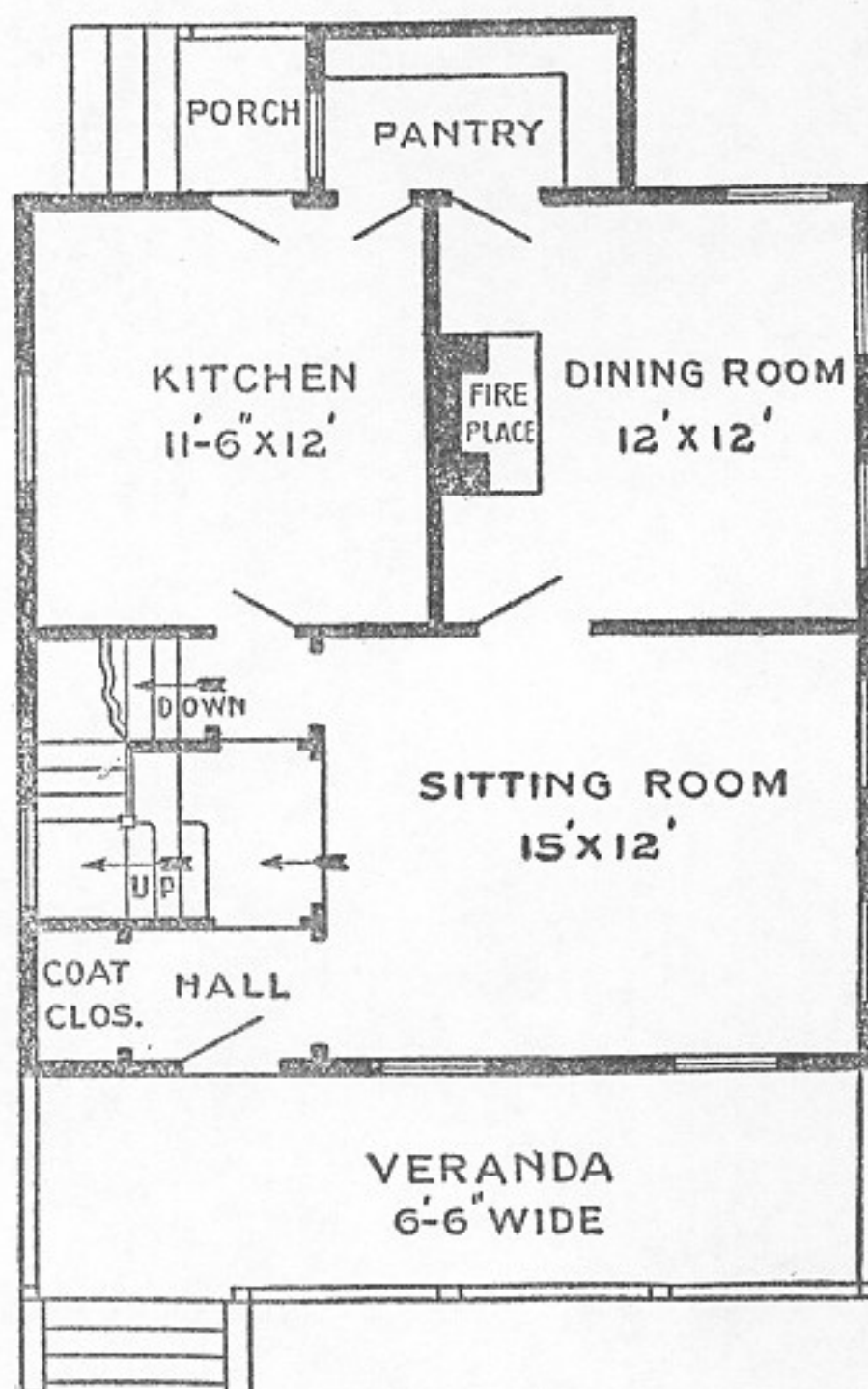
the rooms are of good size and have two or more large windows, which make them light and sunny and supply plenty of good air.

Economy of construction, as well as of doing the work, was kept in mind in the planning. The location of the stairs is somewhat unusual in a house of this sort, but is such that only one light is necessary from first to second floor. There are plenty of large closets on the second floor, which are greatly appreciated.

The porch is not roofed except over the door, but an awning, which is taken down in the fall, makes it cool and shady in summer, and allows the sunshine to reach the living room in winter. The first story is 9 feet from floor to ceiling, the second 8 feet and the third 7 feet 6 inches. The house

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is piped with gas and wired for electricity, provided with the best quality of sanitary plumbing

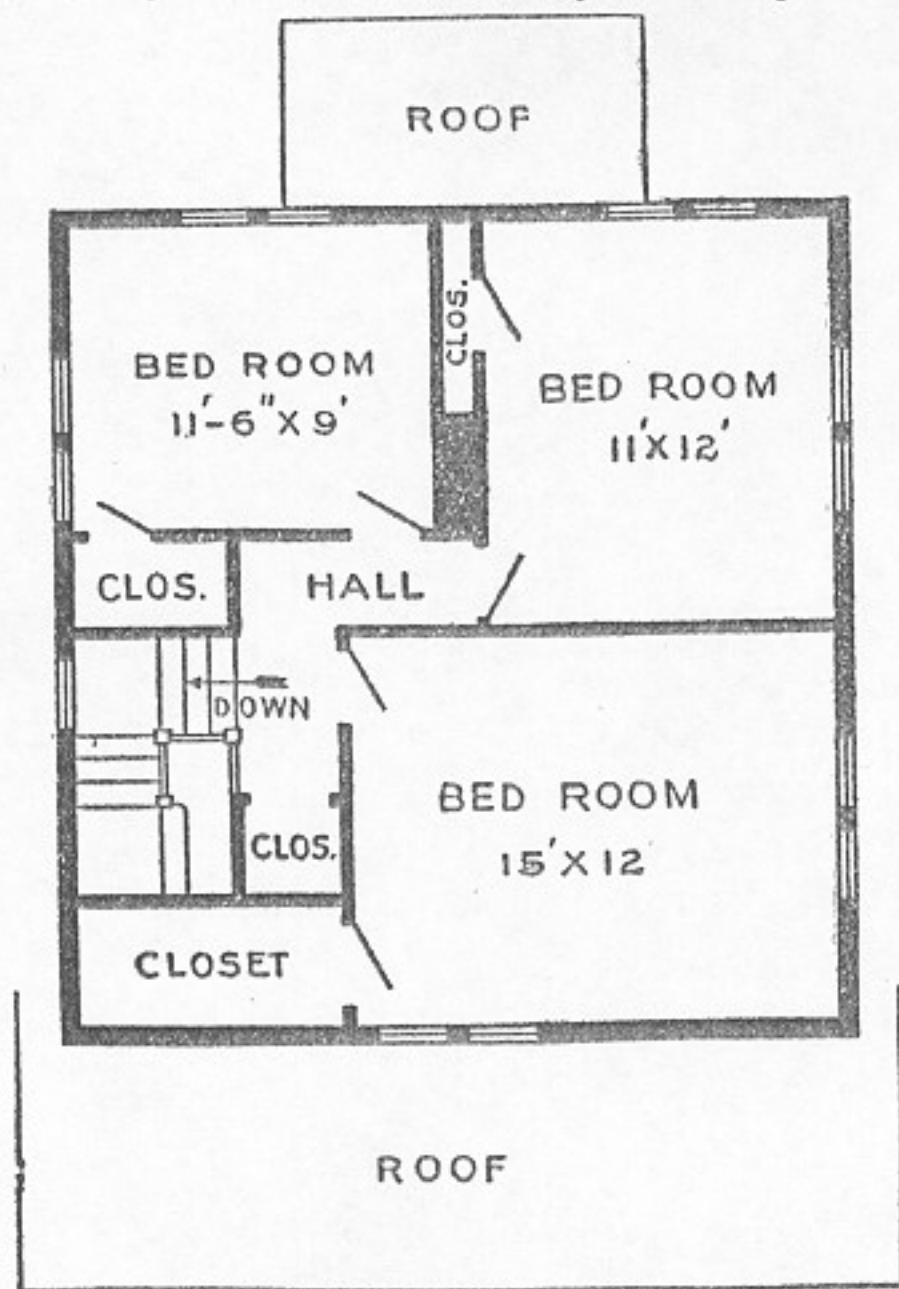


FIRST FLOOR COTTAGE PLAN

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and heated with hot air furnace. A similar house can be built for about \$4,000, more or less, according to finish and locality. Occupancy proves it to be a model of convenience.

If a bigger kitchen is desired, it can be obtained by going back farther. Many would prefer a



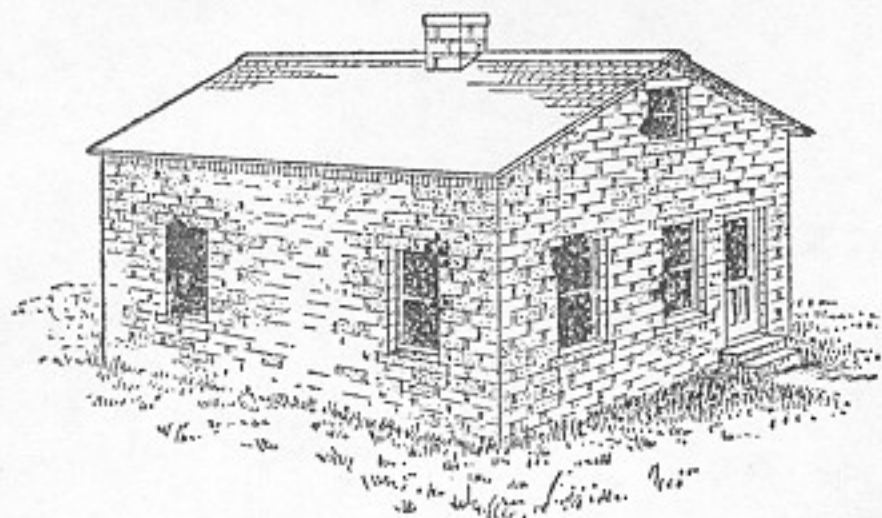
SECOND FLOOR COTTAGE PLAN

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wider bathroom. A foot taken from the back chamber on the right would greatly improve the bathroom and still leave a large chamber. If desired, a large roofed piazza can be added.

BUILDING A BLOCK HOUSE

A Kansas farmer needed a house on his farm, but had very little money. He found that only a little was needed for a cement block house. He ordered a cement block machine and bought 12 boards 10 inches wide and 12 feet long, which were cut in seven pieces of equal length. Two cleats were nailed on each, about 3 inches from the ends. These were for pallets and cost about 7½ cents each. The cement blocks were 8 x 9 x 18. As the block machine had no attachments, some contrivances were



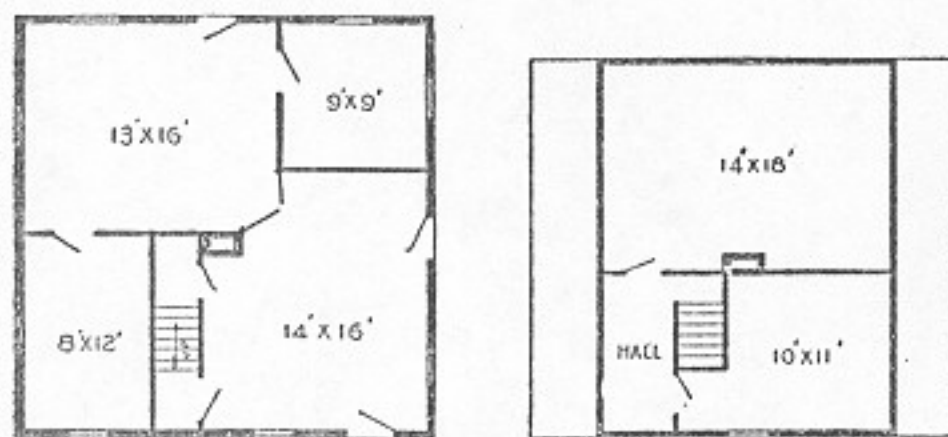
\$400 CEMENT BLOCK HOUSE

made for making half stone, three-quarter and others.

For caps and sills for doors and windows 9-inch boards were taken, using three for each mold, and

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two holes 2 inches from the edges and 3 or 4 inches from the ends of two of them were bored. Then the farmer made cement blocks for the ends 9 x 8 inches, laid the other board on the ground, placed one of the others on each side of it edgewise, put in the end blocks, and through the holes put long bolts and bolted it tight together. Then it was ready to fill with concrete. These boards were as long as were needed to make the caps or sills. A sprinkler, sand shovel, plasterer's trowel, and a wire sieve of ¼-inch mesh were obtained.



FIRST AND SECOND FLOOR PLANS

The sand cost nothing except hauling. The machine was set up near a spring. A box something like a wagon bed with both ends out was made of boards, the block machine placed in one end and the pile of sand at one side. Three shovels of sand and one of cement were placed in a tub and mixed thoroughly. Then a boy took the sprinkler and sprinkled it while another mixed, until it was dampened evenly all through. Then they spread 35 shovels of sand in the mixing box and shook one sack of cement over it, which made a five-to-one mixture. This was thoroughly mixed

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by shoveling and sprinkling until it was good and damp, but not wet. This quantity made ten blocks.

A pallet was placed on the open machine, the machine closed, and some of the richer mixture of concrete placed on the face about 1 inch thick. The mold was then filled with the five-to-one mixture, while one of the boys tamped it, put in the core, and smoothed off the top with a trowel. The core was then carefully lifted out, the machine opened, and the pallet with the stone on it placed on a level piece of ground.

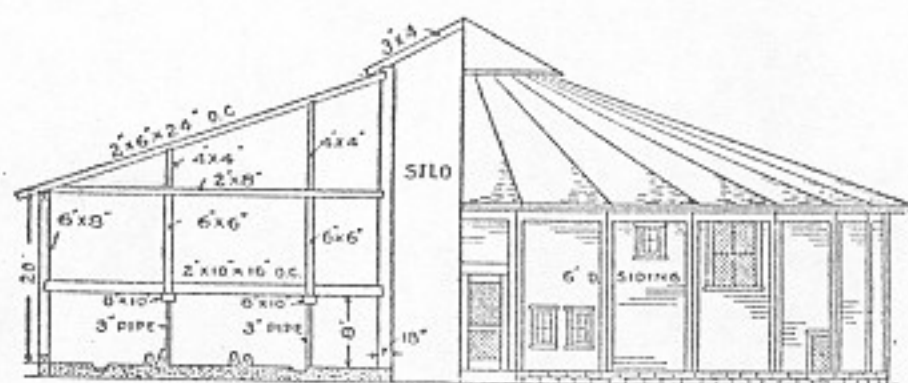
In three or four hours the blocks were ready to sprinkle. When 30 hours old they were placed on end and the pallets used for more stone. After standing for two days, during which time they were sprinkled frequently to keep them damp, they were dumped in the creek, where they were left until ready for use. The foundations were made by first putting into a trench about 6 inches of broken rock, then 4 inches of concrete.

The house is 26 feet square, the walls 12 feet high, with gables north and south. The picture of the house and arrangement of the two floors are shown in the illustrations. We used 12,400 pounds of cement, which cost 60c per 100, or \$74.40. Doors and windows were brought at a cost of \$33.75. Chimney, plastering and lumber for floors, roof, partitions and finishing, all of the best, cost \$240. The hardware was \$30, making the total cost of house \$378.15, not counting cement machine or labor, all of which was done by the family.

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A PRACTICAL ROUND BARN

There is no economy in building a round barn, that is, strictly round. The barn here illustrated has 26 sides nearly 12 feet long, making a barn 94 feet in diameter. The sills, plates and roof in a strictly round barn are very expensive, and the work will not last as well as when built as shown. The floor space of the first floor is nearly the same as if round, and the hay loft is very little smaller. If the building is round, the walls should be lathed



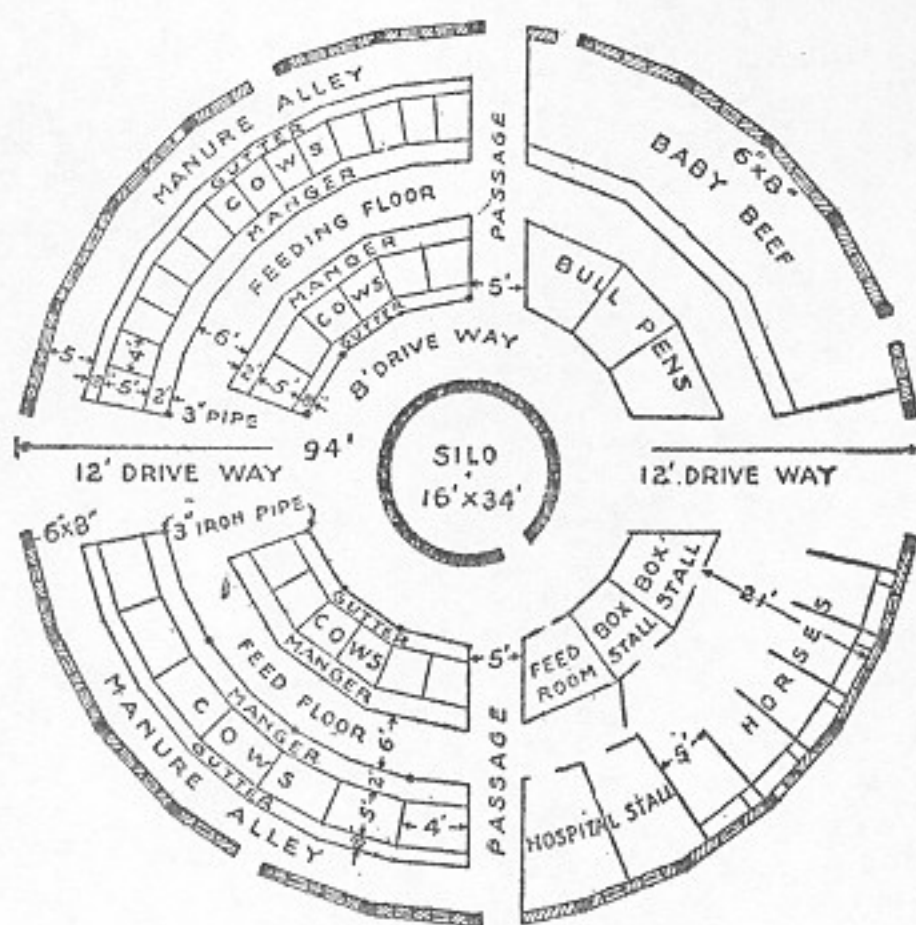
CROSS-SECTION OF BARN

with metal lath, over rough boxing, and plastered with two coats of portland cement. In fact, this finish is to be preferred in building any shaped barn, as it requires no paint and practically no repairs.

The floor plan of the barn shown is self-explanatory. It has stalls for 40 milch cows, three bull pens, two hospital stalls, pen for baby beef that will accommodate about 2½ cars of calves, stalls for seven horses, including the two box stalls, and the feeding room and silo. The silo is 16 x 34 feet, will hold about 140 tons of silage, and requires about ten acres of average corn to fill.

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The hay loft has 166,500 cubic feet of space, and deducting the silo and bins for ground feed will hold 300 tons of loose hay. The ground feed is stored in hopper-shaped bins above the feed room, and drawn down through small spouts as wanted. The hay is handled with hay forks, and to locate



FIRST FLOOR PLAN

the trolleys as near the roof as possible, trap doors are left in the loft floor, and the hay hoisted from the driveways. A circle trolley may be installed, or two straight ones. Several large hay doors are also built in the outside walls above the loft floor. The silo, the floors of the cow stalls, including

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the gutters and mangers, also the 8-foot driveway around the silo, are of cement, and, while it is intended to install litter and feed carriers, it is also intended to drive around the entire barn, or the feed

floor with a cart if desired. The interior arrangement of first floor may, of course, be changed in several ways, and the cows faced in the opposite direction, etc., or stalls and other equipment arranged for different stock.

The barn, as shown, has about the same floor space as a barn would have 36 feet wide and 180 feet long. The ventilation is always much better in the round barn, the work of caring for and feeding may be accomplished with less labor, there are never any drafts on the stock, the building may be built for less money, and is much stronger. As shown, the barn has a stone foundation, the roof is covered with asbestos roofing felt, and the walls covered with 6-inch drop siding. Everything is of the best, and all exposed woodwork painted two coats. This building would cost about \$4700 without the cow stanchions. Where home labor is used, and the lumber can be secured for less than \$30 per thousand, the barn may, of course, be erected for less.

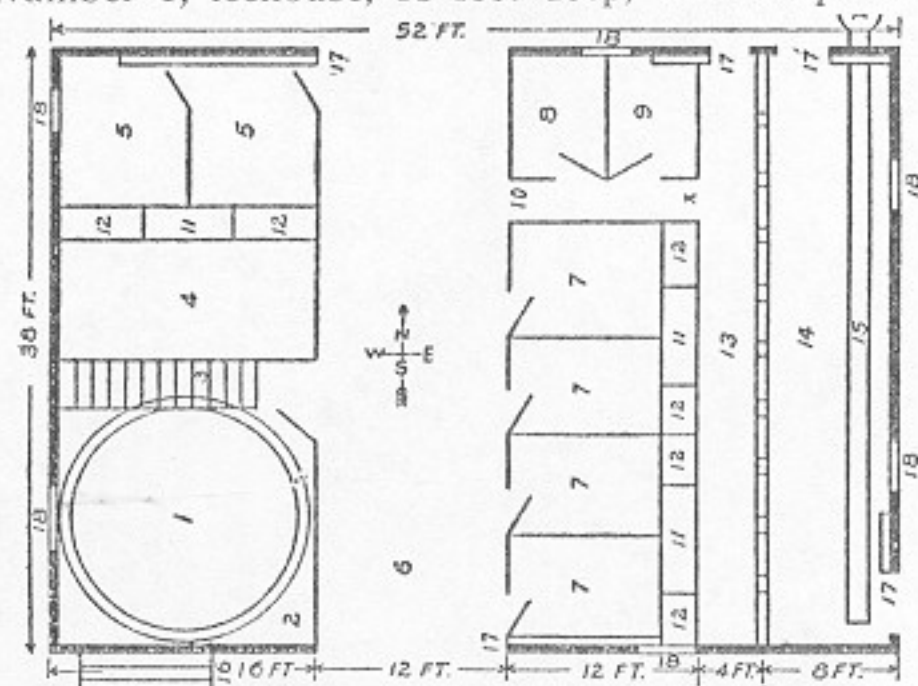
A WELL-ARRANGED BARN

This Kentucky barn has a frame of oak, 6 x 6 inches. Center posts 23 feet 9 inches; shed posts 16 feet tall; studding and braces 2 x 6-inch poplar; joists 2 x 10-inch poplar, oak and pine. The sheeting is of poplar, beech and ash. The bevel siding is select poplar. Cornice and base, white pine. All doors are two thicknesses, front is dressed cypress and the back dressed white pine. The

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lower windows are 10 x 12-inch, 12 lights and upper ones inside the building. The joists are set 20 inches from center to center. The loft is 8½ feet from lower floors.

The floor plan shows the arrangement as follows: Number 1, icehouse, 18 feet deep, walled up with



GROUND PLAN OF A KENTUCKY BARN

stone; 2, carriage house, 16 x 18 feet; 3, stairs, leading to lumber room over carriage room; 4, corn crib, 8 x 16 feet, over which are the grain bins for wheat and oats. These bins have chutes running down into the corn crib, from which grain is filled into sacks. Numbers 5, 5, are box stalls, 8 x 12 feet; 6, driveway, 12 x 38 feet; 7, 7, 7, 7, box stalls, 6½ x 12 feet; 8, harness room, 6 x 8 feet; 9, feed mixing room, 6 x 8 feet, with spouts running from cutting box and bran bins overhead; 10, alleyway running from driveway to feed alley; 11, 11, 11, hay

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chutes, with openings near the bottom, 1 x 2 feet. These openings are directly over the feed boxes and any hay that falls while horses are feeding goes into the boxes and none is wasted. Number 12, feed boxes, 1 x 2 x 2 feet; 13, feeding alley, 4 x 38 feet.

Overhead at X is an opening from the hay loft where alfalfa, clover, cowpeas and hay are kept for the cows; 14, cow shed, 8 x 38 feet. Cows are fastened with stanchions and fed out of boxes on alley floor. The cow shed has concrete floor, with a fall of 2 inches from stanchion to Number 15, the drain basin, which is 1 foot 2 inches wide and 1 foot deep at A, where it runs into a basin made of concrete, 6 x 6 feet and 2 feet deep; 16, driveway into carriage room; 17, openings in which siding doors hang when open; 18, windows.

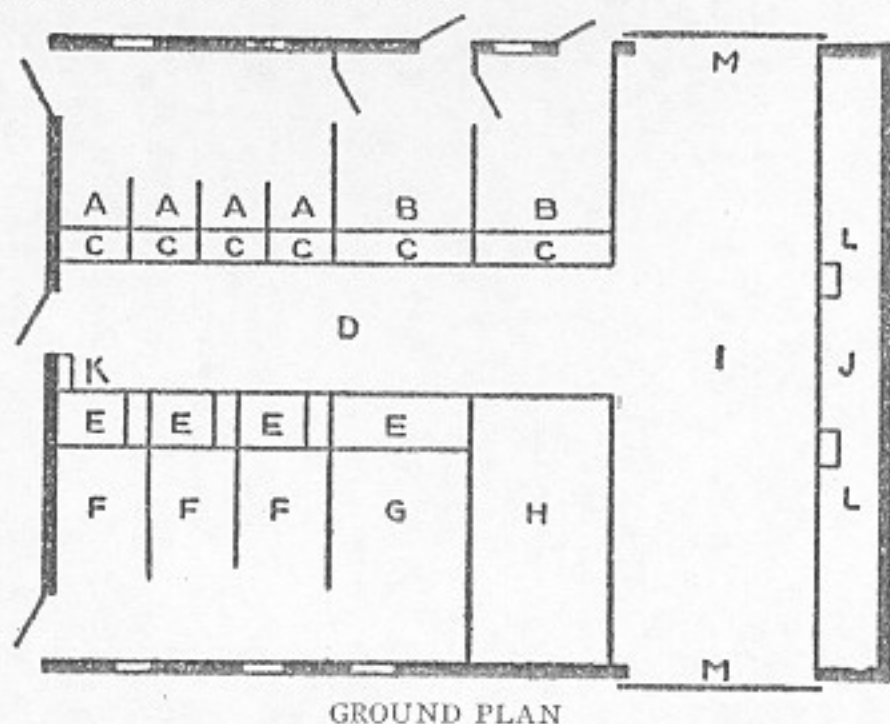
The roof is of tin, standing seams, with Yankee gutters made on the lower edge of the roof. An opening 10 x 10 feet in the center of the driveway loft is allowed for hay and other feed taken up by an unloader that runs on a track in comb of roof. The barn will cost about \$1500—more or less, according to cost of building material where it is erected.

A HANDY SMALL BARN

This barn is arranged to meet the needs of a small farm. It can be built in most localities at a cost not to exceed \$500, and if a farmer has his own timber, at even less cost. The outside dimensions are 36 x 48 feet, and it is 16 feet to the eaves, with a curb roof. The stables should be about 8 feet high, which allows plenty of loft room above for hay.

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In the floor plan the cow stalls, A, can be made of any width desired, 3½ feet being best for general purposes. At B are two large box stalls for cows with young calves. The mangers, C, are 18 inches wide, with a rack for hay or fodder above. At D is the feed room and alley, which is 8 feet wide. At E are the mangers for the horses, with



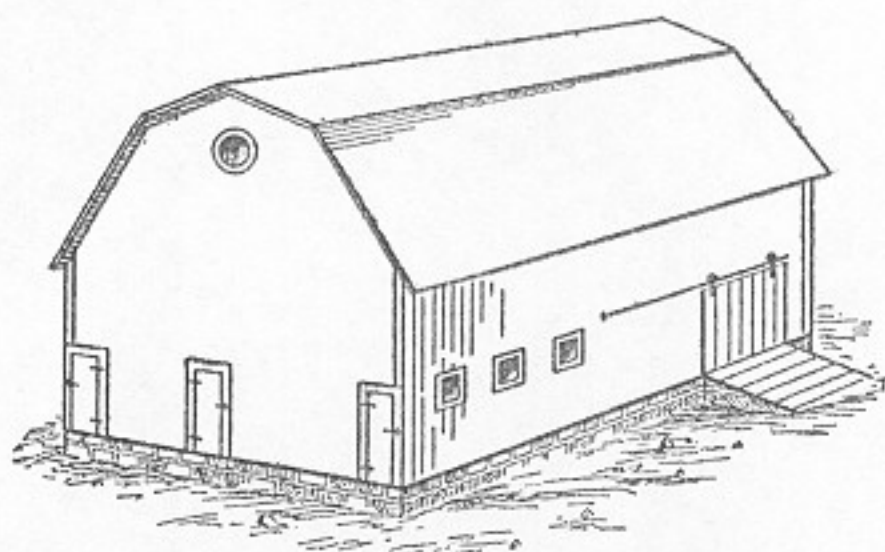
a feed box at the right side. At F are three horse stalls 4 feet wide, in which horses can be tied. At G is a large box stall for mares and colts.

At H is provided the granary, which can be subdivided into bins as necessary. The portion I is the driveway, which affords ample storage space for tools, wagons, etc., and is used as a driveway when hay is being elevated into the loft above.

There is a large corn crib, J, at the end, which can be filled from the outside and emptied from the inside. It is narrow and so arranged that the

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corn will dry out quickly. Chutes from this bin should be provided at L. A ladder to the hay loft at K is a convenience which should not be omitted.



VIEW OF COMPLETED BARN

THE FARMER'S ICEHOUSE

In a properly constructed icehouse, and when the ice is properly packed and cared for, no waste should take place from the inside of the pile of ice. The melting from the sides, bottom and top is caused by insufficient insulation. The waste from

the bottom is generally the greatest. The amount of ice melted in the bottom of the icehouse varies from 1 to 6 feet during the year, depending upon the construction of the floor. If the icehouse is provided with an airtight floor, with the ice laid on at least 18 inches of dry sawdust, the bottom waste rarely exceeds 12 inches during the year; on the other hand, if the ice is piled in the icehouse on the bare ground without any insulation under it, or any provision made for drainage, the meltage fre-

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quently is 6 feet. The side and top meltage is not so great, but it frequently ranges from 1 to 3 feet, depending upon the insulation.

Location and Building

The location should be where the ice can be removed and delivered with the least amount of labor; however, it is very important that the icehouse should be located in the coolest place, in as dry a place as possible, and always above ground. The lowest layer of ice should always be at least 6 inches above the outside level of ground.

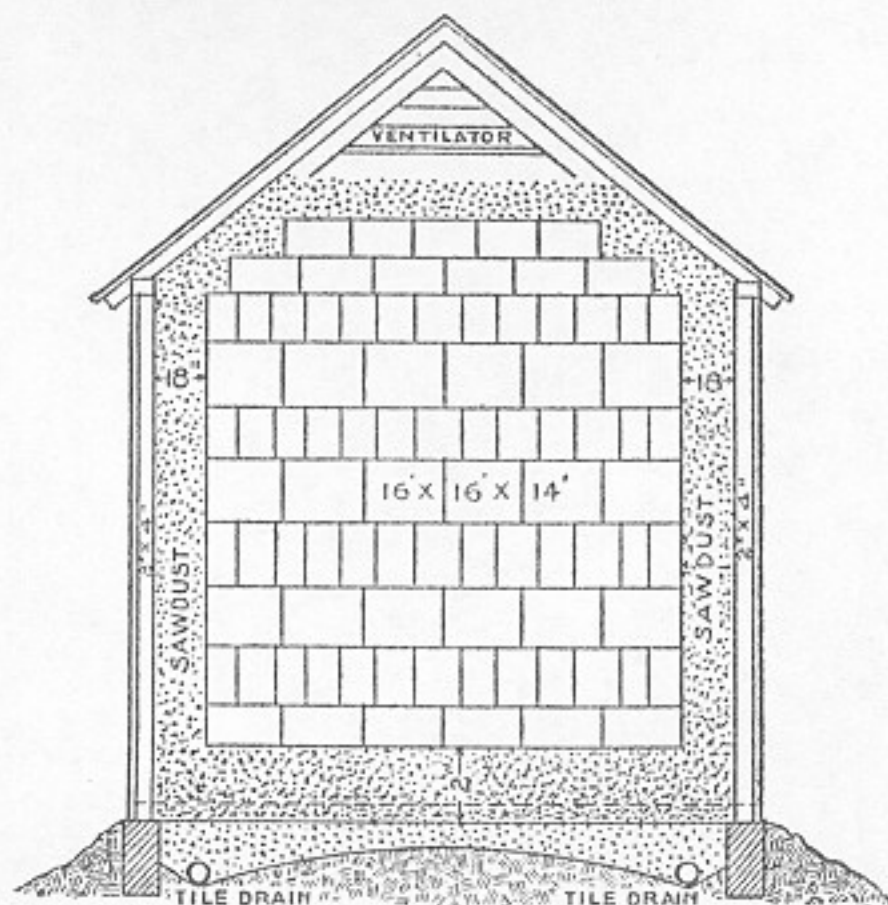
The size of the building must be determined by the amount of ice used during the year. For instance, a dairy farm upon which 35 cows are kept, and from which the milk is sold, needs an icehouse 16 x 16 and 14 feet high. If the cream is to be sold and skim milk fed to the calves, immediately from the separator, an icehouse 14 x 14 and 12 feet high is of sufficient size. In both cases we make allowance for the use of 25 pounds of ice per day during the summer months for household purposes. For a man who keeps about 20 cows and sells the milk, an icehouse 14 x 14 and 12 feet high is of sufficient size; however, in no case should an icehouse be smaller than 12 x 12 and 10 feet high, because the outside surface is too great, compared with the volume, and, therefore, too much ice is wasted in proportion to the amount used.

The building should be as near the shape of a cube as possible, for the cube contains the greatest amount of volume with the least amount of surface exposed other than circular forms. It is not always practical to build as high as we build square,

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owing to the amount of labor and the inconvenience of storing the ice; therefore, the dimensions given are really the most practical.

If the icehouse is not built upon a sandy surface and where rapid drainage is natural, it is necessary to cut a space to a depth of 12 to 18 inches, where the icehouse is to be located, lay a



CROSS-SECTION OF ICEHOUSE

tile drain to drain this, and fill it with sand or finely crushed stone. Put a 6-inch foundation of concrete of the size you wish to build your icehouse in this pit, and fill around the outside.

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Framing the Icehouse

The framework is made by laying 2 x 4-inch sill on the concrete foundation; fasten this to the foundation by cementing a few bolts into the concrete and allowing them to extend through the sill; 2 x 4 studding are then placed upon the sill, 16 inches apart from center to center. The rafters for the roof are likewise made of 2 x 4's, placed the same distance apart as the studding, but the purlin plate upon the studding should be at least 6 inches wide. The outside of studding may be boarded either with common sheeting and paper, upon which poplar siding is nailed, or with patent siding or ship-lap siding, the latter being the cheapest and requiring only a single thickness of board.

The roof should be made with not less than one-half to one-third pitch, and preferably covered with shingles, for shingles are better insulators than either slate or metal. Paper may sometimes be used to good advantage. A cupola or flue should be built upon the roof to allow for the removal of the warm air from the top of the ice. A ventilator may be placed in the gable end.

A continuous door should be cut in one end to allow the ice to be put in. This door may extend from the gable down to within 5 feet of the bottom.

Before putting in the ice place from 18 inches to

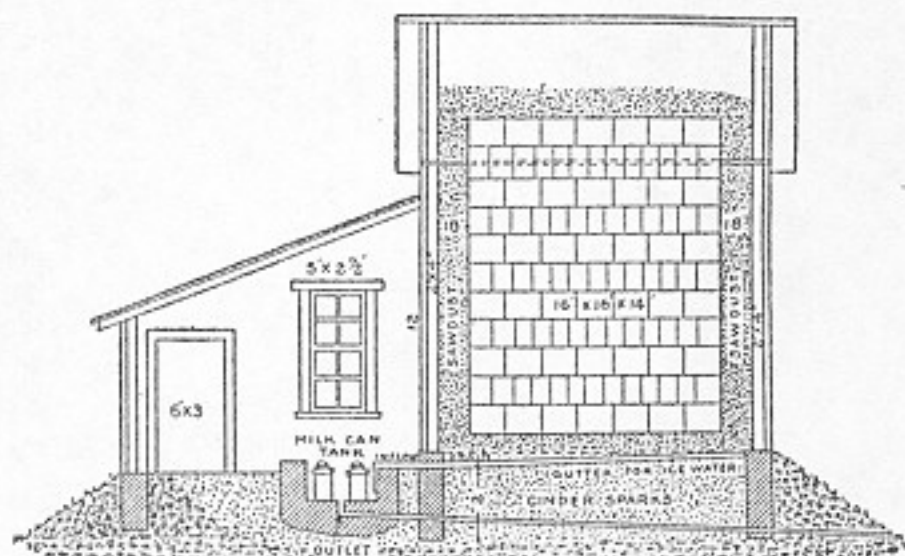
2 feet of sawdust or dry peat upon the floor. The ice should be harvested in regular shape, oblong, rather than square, and not less than 18 inches in width and 30 inches in length.

Ice and Milk Houses Combined

The side elevation of an icehouse with milkhouse attached is presented in the drawing. It shows the

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advantage of utilizing the water from the icehouse for cooling the milk. No ice needs to be removed from the icehouse. It operates automatically. If the weather is warm the ice melts more rapidly and keeps water in the tank at the required temperature.



A GOOD COLD COMBINATION

SMALL GREENHOUSES

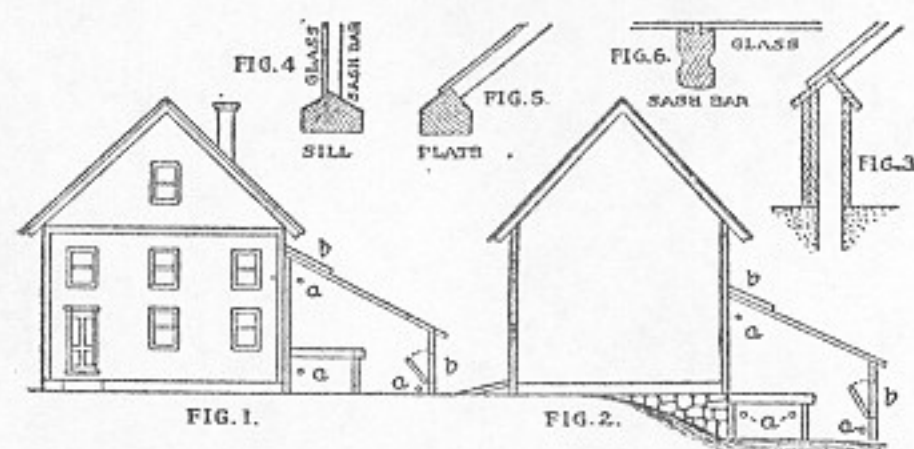
The farmer who would make his crops of vegetables most profitable, or the small gardener who would have an early supply of early vegetables for home use or market must employ some kind of glass structures to hasten these crops. The hotbed or cold frame have been much in use in the past, but the cost of sash, shutters and mats is nearly as much as the materials needed for a permanent structure, while the labor of caring for cold frames or hotbeds is often much more than that of the small greenhouse. In the latter one may work with comfort no matter what the weather may be outside. It requires much more skill to run hotbeds successfully.

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Small greenhouses may be built against the south side of the house or stable, Figures 1 and 2, or they may be built entirely away from other buildings, but the shelter of larger buildings on the north or west will be found of great advantage. If one has a basement to the house or stable, a lean-to house may be built, and heat from the open cellar in a large measure will heat the greenhouse in the mild weather of fall and spring.

Material for Construction

A cheap and efficient house may be made by setting chestnut or cedar posts in the ground, covering the sides with lining boards, then two thicknesses of tarred building paper and sheathing



DETAILS FOR SMALL GREENHOUSES

outside, Figure 3. Cement, stone or brick will be cheaper in the end. The durability of glass structures will depend much upon the form of the materials. Clear cypress is now more used than any other material. Sills should be of the form shown in Figure 4. Plates may be made of plank as in

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Figure 3, or as in Figure 5. Sash bars should have grooves along the sides to catch the drip from the glass, as in Figure 6.

The glass for ordinary work may be No. 2 double thick, large sizes, 16 x 20 inches or 20 x 24 inches, being much used. Smaller sizes will be cheaper in price, but more sash bars will be needed, and they cut off much of the sunlight. The glass should be put in with putty, made with about one-third white lead in it, and firmly tacked with triangular zinc tacks of large size, or the double-pointed tacks, which are so bent as to prevent the glass from slipping down.

Set Glass in Warm Weather

Glazing should be done during the summer or early fall, as putty will soon become loose if frozen before well hardened.

In building there should be no mortises, but all joints be made by toeing in with long, slender nails. All woodwork should be thoroughly painted before fitting, and all joints filled with white lead paint. After all is done the frame should be painted before the glass is put in.

The most important and expensive feature of the small greenhouse is the heating. If one has a hot water or steam heater in the house, to which the glass house is attached, it will be a very simple

matter to carry pipes through, as at *a, a*, Figures 1 and 2. Hot air also may be let into such houses, or a small kerosene heater in very cold weather may be used, if the house is built opening into the cellar.

Ventilators must be located as shown in Figures 1 and 2, at *b, b*. Very small structures may be

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run without much heat if opening into cellars or other heated rooms by having shutters or curtains to draw down at night and in very cold, cloudy weather.

Covering with Hotbed Sash

Houses of small size may be made by building a frame upon which hotbed sash may be screwed. If one has the sash this is a cheap way of building, and such a house has the advantage that the sash may be entirely removed during the summer, but it is very difficult to make a close house with such sash.

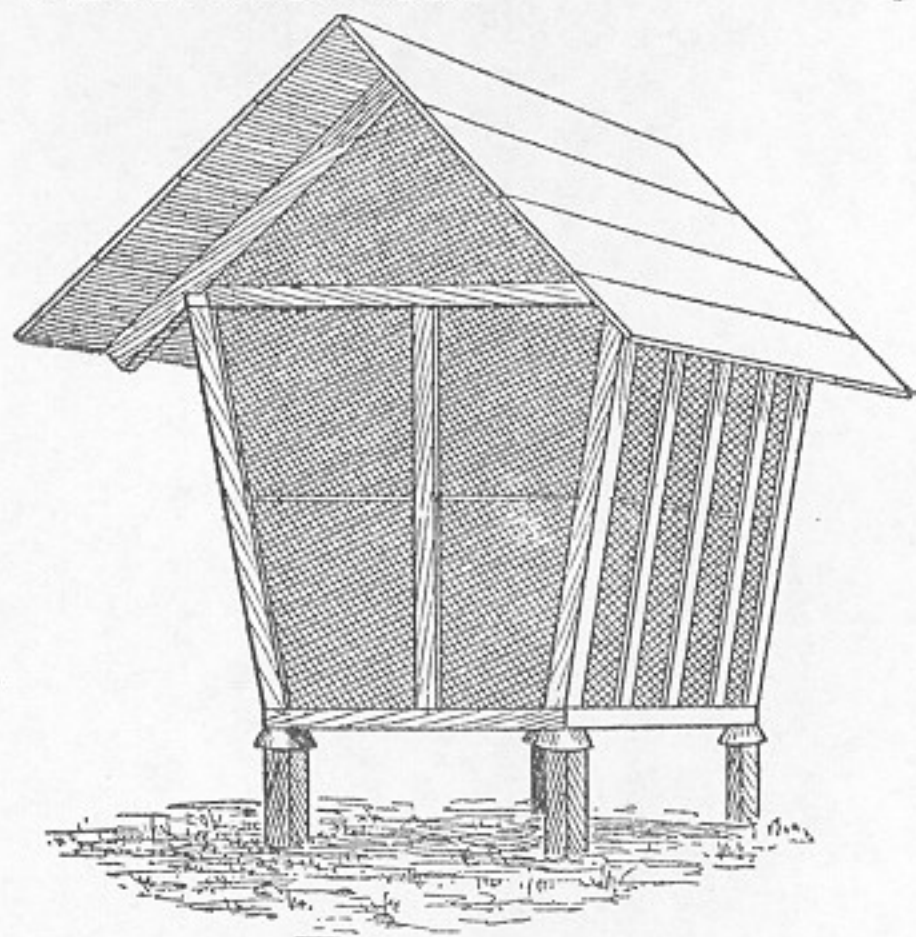
The woodwork of greenhouses and hotbed sash should have a coat of thin linseed oil paint every second year. Much of the success to be obtained from any glass structure will depend upon the skill of the operator, and the thermometer, both outside and in, must be watched very closely. The temperature should be maintained as nearly as possible like that in the open air under which the plants grown thrive the best.

WIRE FENCE CORN CRIB

In the drawing is shown a handy, inexpensive corn crib, which possesses several advantages not possessed by the ordinary slat corn crib. It is made on 4 x 4-inch posts, with pans at their tops, to prevent rats from climbing in. The sills are 4 x 4-inch, the scantlings 2 x 4, and 2 feet apart. The fencing is nailed to these on all sides, and the door frame is similarly covered. The roof is made wide, so as to shed all possible water. The height, length

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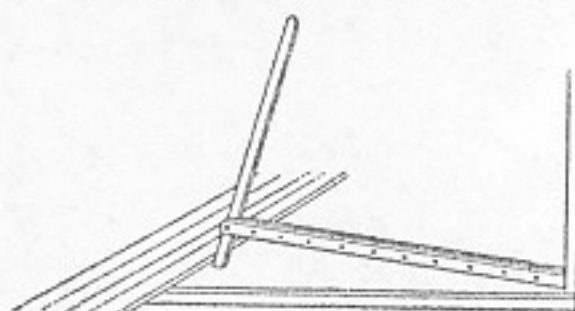
and width may suit the farmer's convenience. A convenient width is about 5 feet at the floor, widening to 7 feet at the eaves. Owing to the very open nature of this crib, corn dries more quickly than in a slat crib, and as there is less chance for water to lodge in the cracks, the crib will be more durable than if built entirely of wood.



THE CORN CRIB
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HOW TO LAY A FLOOR

To lay a floor or board ceiling just right, and do the work fast, use a good lever, as in the illustration, taking for the supports two 1 x 4-inch pieces as long as the width of the room. The upright arm is 4 feet long with a hole 4 inches from the lower end and through which it is pinned loosely between the ends of the supports. With a little practice, a good carpenter's job can be done on floor or ceiling.



FLOORING LEVER

AN INEXPENSIVE VERANDA

A vine-covered veranda is a great comfort, but in many cases the expense seems greater than the owner of the plain little farmhouse feels able to stand. A farmer in Arkansas wanted one, and he set to work in this fashion. First he went to the woods and got a load of straight poles about 1½ inches in diameter and from 8 to 12 feet long. He next procured a number of nice, smooth boards for the flooring of the veranda, making it about 6 feet wide and 10 feet long and strengthening it with the necessary timbers. He securely nailed the poles about 8 inches apart around the flooring to form an inclosure, leaving an opening in front about

5 feet wide.

The poles in front were 7 feet from the floor to the roof and 12 feet at the house. About midway of their height the poles were straightened by a row

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of poles nailed horizontally and another row was placed at the top. To make all secure against rain, the slanting roof poles were next carefully covered with overlapping rows of bark. All this required but small outlay of cash and even less of work. It was then ready for the vines.

Being in haste for immediate results, the builder planted some roots of the hard native woodbine, which will soon cover any space with its rapid growth. It is an easy matter to sow seed of the morning glory, hardy annual gourd, or any one of several hardy climbers and the result will soon be a mass of shade and lovely blossoms besides, all of which makes the summer evenings pass far more pleasantly.

CONCRETE ON THE FARM

The progressive farmer must not overlook the economic value of portland cement concrete. To-day is the age of concrete. It is crowding wood and steel into the background, and bids fair to become the most universal of building materials. Concrete is extensively used by the largest landholders, and can be used by the men of more moderate means to equal advantage. It is to be recommended for general use by reason of its durability, sanitary qualities and moderate cost. Molded solid, it has no joints nor seams to afford a lodging for dirt and foster the growth of noxious fungi; it can be swept, washed, scrubbed and scalded, without injury to its texture. Further, it does not possess the disagreeable quality of absorbing gases and odors. Add to these qualities, coolness in summer, warmth in winter and we have one

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of the most logical building materials in present-day use.

Concrete is not expensive when compared with other materials of construction, such as stone, brick and wood. To be sure, the initial cost of wood is less than that of concrete, but when we consider the life and quality of the finished product, concrete is easily cheaper than wood.

Portland cement of the most approved brands costs about \$1.60 per barrel, 1¼ barrels of cement being required for each cubic yard of concrete. Sand and gravel may be had from the farm or bought nearby at 10 cents a load. Add the cost

of the forms and the labor of mixing and laying the concrete, which should be done at an expense not exceeding 75 cents per yard, and we have a total expense ranging from \$2.75 to \$3 per cubic yard, but under very favorable circumstances the cost may be reduced close to \$2. Experience both in practical work and in the laboratory has proved beyond a doubt that the best brands of cement, as in all other goods, are the cheapest in the end, and should be insisted upon by all prospective purchasers. Atlas, Alpha, Saylor's, Edison and Giant cements are among the leading brands. The sand should be clean, coarse and sharp and free from all foreign matter that would in any way tend to weaken the concrete. Broken stone with sand and cement makes an ideal mixture, but it is objected to on account of the cost of the broken stone. Gravel may be substituted for the stone, however, with excellent results. The gravel should be washed and cleaned, and, if very coarse, passed through a screen. The gravel should range from $\frac{1}{4}$ inch to $2\frac{1}{2}$ inches in diameter, but should not exceed $2\frac{1}{2}$

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inches and to obtain the very best results the major portion should be between the limits of 1 and $1\frac{1}{2}$ inches.

MIXING THE CEMENT

In mixing concrete for general use the following proportions are perhaps the best: One barrel cement to 3 barrels sand and 5 barrels gravel. In this mixture the spaces between the stones are entirely filled and when hardened the concrete virtually becomes a solid monolith.

To secure the best results mix the concrete as follows: Have the gravel washed and in readiness, usually on a platform of planking or boards, to permit easy shoveling and insure against waste. Add enough water to the cement and sand, which have been thoroughly mixed in a mortar bed, to make a thin mortar, not too thin, however, to permit easy shoveling. Spread the mortar on the gravel and thoroughly mix by turning with shovels. Then, without delay, shovel the batch of concrete into the forms or spread it on the floors as the case may be, being careful not to exceed layers of 8 inches at each filling. Each layer must be tamped and rammed till water flushes to the top.

Proceed in this manner till the forms are filled. In hot weather damp cloths or boards should be placed over the top of the concrete to keep it from checking after the final layer has been placed in the forms. The forms must necessarily be water tight and the concrete worked back from the boards with a spade, so the softer material may flow to the

outside and insure a smooth surface. If this last is not done holes will surely result and the work will be disappointing. Let the concrete rest four to six days before removing the planking, concrete

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being somewhat brittle until thoroughly hardened, and while in the "green" state easily broken.

MAKING CONCRETE BLOCKS

Concrete building blocks are ideal as building material on the farm. The cost to purchase these blocks has been beyond the reach of the farmer who desired to use them for all purposes; but by the use of the simple machine or mold described anyone can make the best quality of hollow concrete building blocks at an average cost of less than 6 cents each, the mere cost of sand and cement.

As the standard size block is $20 \times 8 \times 7\frac{1}{2}$ inches, instructions are given for making the machine to build that size, but it can be constructed to turn out any size of block by changing the dimensions accordingly.

Take two boards 20 inches long by $7\frac{1}{2}$ inches wide and 1 inch thick. These are for the sides. For the ends use lumber 10 inches long by $7\frac{1}{2}$ inches wide. Care must be used to have the boards free from large knots and with an even grain, so as to avoid warping.

The above four boards were joined at three corners with six hinges; two hinges at top and bottom of each corner. In putting together have the two end boards set up against the sides as shown in Figure 1. At the fourth corner place a strong hook and eyelet to hold the machine together when making block, and by unhooking this allows the machine to be folded back away from the finished work, etc.

This makes a mold or form that is, inside measurements, 20 inches long, 8 inches wide and $7\frac{1}{2}$ inches high, with top and bottom open.

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For the core, take two boards of 1-inch lumber, cutting them 13 inches at the top and slanting to $11\frac{1}{2}$ inches at the bottom with a width of $7\frac{1}{2}$ inches. These make the sides of core. For the ends, use 2-inch strips cut $7\frac{1}{2}$ inches long. These are fastened together,

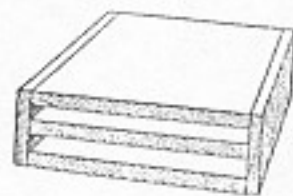


FIGURE 1—CORE as shown in Figure 1. This makes a slanting box which is set inside of the machine, as illustrated in Figure 2, and forms the hollow in the block. To the top of the core a round stick is fitted into place the length of the core, so it will set down level with the top for a

handle to lift the core from the block when operating the same.

To Operate the Machine

First set it on a board somewhat larger than the machine, as shown in Figure 2. This makes the bottom of machine and holds the block until dry. Enough of these boards must be provided for the

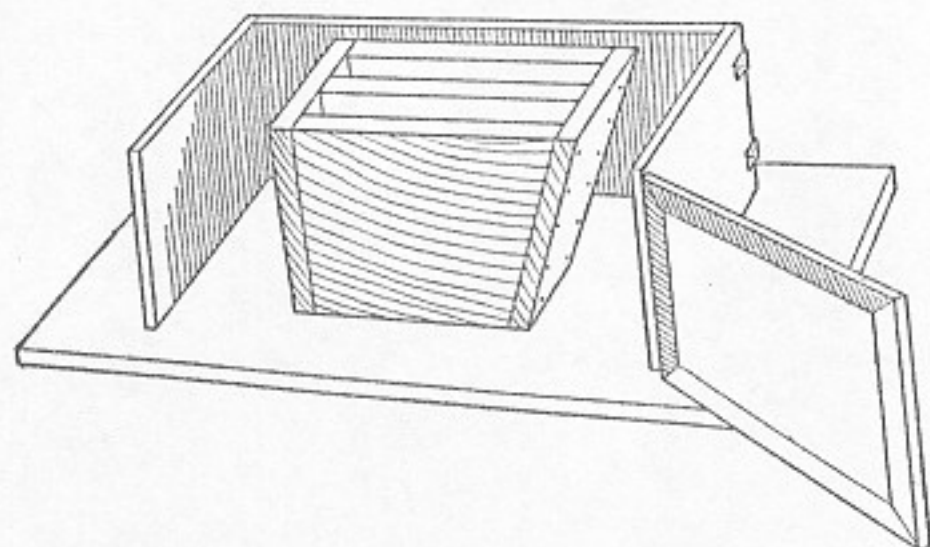


FIGURE 2—CEMENT BLOCK MACHINE OPEN

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blocks made each day. Close the machine and fasten catch, then set the core in the center and fill the space around the same with the concrete mixture, tamping it in thoroughly. When full level off the top with a flat stick and carefully lift out the core, setting it on another board ready for the next block, unhook the catch and fold the machine back away from the finished block and you have the completed block ready to dry and cure. This method requires no handling and so has no danger of breaking while the block is yet "green," as it remains on the board or "pallet" until dry enough to be piled up, which they will be in three or four days.

When the blocks are to be laid in a side wall, between corners, take two $1\frac{1}{2}$ -inch strips $7\frac{1}{2}$ inches long and attach with screws to the center of each end of machine on the inside. This molds a groove in the block, which is filled with mortar when laying the block in the wall and so securely ties it. By fastening with screws these strips can be easily removed when molding corner blocks.

Blocks of Different Shapes

A neat panel block can be molded by taking the common half-round strips, cutting to the right lengths and fastening to the outside of the face of machine, as shown in Figure 1. For corner blocks they can be attached to either end of machine. By using small screws these can be removed when not desired and also enable you to panel either right

or left end of block as needs require.

For making half-size blocks, have a piece of board that is exactly 8 inches wide and $7\frac{1}{2}$ inches high, or so it will just fit into machine when core

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is removed. Set this in place in the middle half-way between the ends and fill with material. This will make two half-size blocks for use in breaking joints when laying wall. If desired to have these hollow, two small cores of proper size can be made to set in place when molding blocks of this size.

Rock face effects can be produced very easily by taking a 2-inch plank the size of the face of machine or the end as desired. On this draw a border $1\frac{1}{2}$ inches all around, then take several irons, heat them red-hot and burn out the center in irregular shape, at least $1\frac{1}{4}$ inches deep. By making ridges and hollows in this burning process of different depths and as broken as possible, you will secure a face plate that will mold a very excellent imitation of a rock face. This, of course, can be made to suit any fancy.

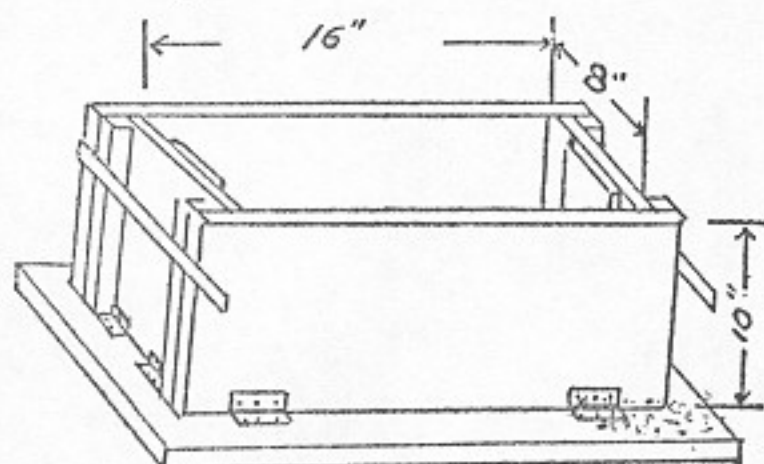
One may follow the practice of making several faces and ends from plain and panels down to different rock effects, having these extra face plates the same size as given for the machine above. Then by using hinges as used on doors or any pin hinge, you can easily change the style of block by putting one face plate or end on machine in a moment's time. One machine can thus be used for any style of block and a great amount of time be saved in changing from one style to another.

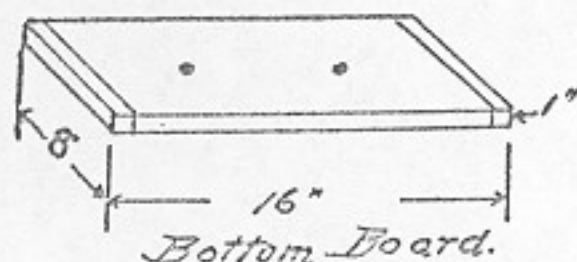
This machine, in addition to being simple in construction and operation, is very rapid. With but little practice one man can make from 75 to 100 blocks daily and have each one perfect, as he does not break any by handling them after they are molded

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ANOTHER STYLE OF MOLD

All the lumber necessary to make this mold should be selected white pine or hardwood, free from knots and sap. The platform on which this mold rests should be 14 x 24 inches and be well battened together. The sides are made as shown





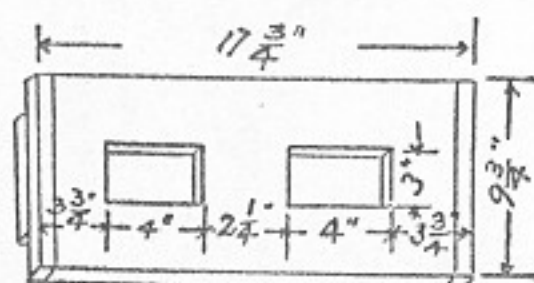
THE FINISHED MOLD

by the drawings, with a cleat on each end, which overlaps the end pieces and holds them in place. Both ends and sides are fastened to the platform as shown, with hinges, which permit them to be turned down to take out the completed block.

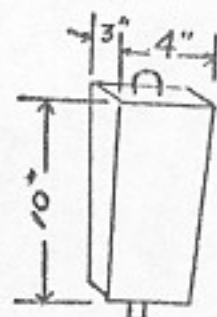
On each end is placed a flat iron bar with a notch in to fasten the whole mold together. These bars are the same as hooks, only the ends are prolonged to act as handles for convenience.

Regulating the Height of the Blocks

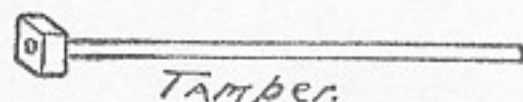
The bottom board is intended to be fitted in the bottom of the mold loosely and should be blocked up from the bottom to give the required height of



Guide for plugs



Plug or Core.



PARTS OF MOLD

the finished block. The end pieces of mold have a thin piece of board running up and down to form a key between blocks and should run down to top of bottom board.

The plugs are made as shown, with a taper both sides, so that when they are removed they clear all the way out. The pins in the bottoms of the plugs

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are to fit in the holes in the bottom board, which will steady them and hold them in place.

When the plugs are removed the board with the two square holes is placed over the top of mold and the handle of tamper is run through the rings in top of plugs and they are lifted up. This board is used as a guard and prevents the block from being broken when plugs are removed, and should not be used until the block is finished and ready to take out of mold. The tamper is made of a large iron nut and a piece of iron rod about 18 inches long.

Filling the Molds

To make these blocks use one part of portland cement and three parts of good sharp sand, mix well and put enough water on to simply dampen the whole. Now close up the mold, put plugs in place, fill the mold one-fourth full and tamp down hard. Repeat this until the mold is filled. Scrape off surplus material, remove the plugs, then turn down sides and lift out finished block which is to remain on the bottom board until hard enough to lift off.

It will be necessary to have a number of these bottom boards. After a number of blocks are made they should be sprinkled from day to day for from 15 to 20 days to properly cure them before using. A barrel of cement will make about 50 blocks and one man can make a block in 12 minutes.

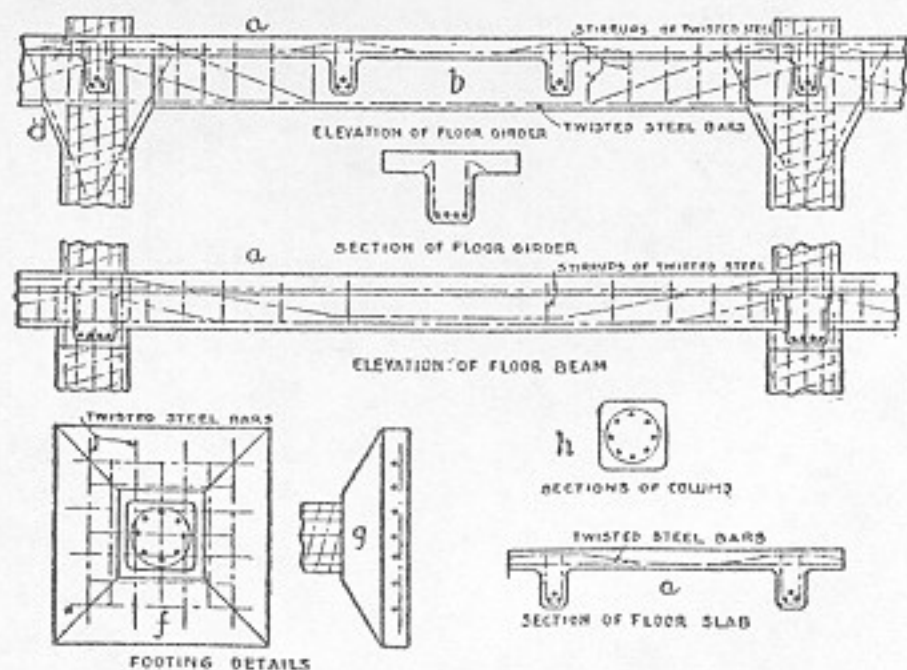
MIXING CEMENT FOR BRICK

Many have found mixing the sand and cement the hardest part of cement brick making. An old vinegar barrel may be put to use by placing a grindstone crank on one end and a pinion on the other. Two strong posts are set in the ground and the barrel hung over two pieces of round iron driven into the posts. A square hole is cut on side of barrel and covered with a piece of sheet iron hinged and a bottom to fasten.

The sand and cement are dampened, shoveled into the barrel and a boy may turn the crank. The mixing is done as fast as two men can mold, with a boy to sprinkle the brick to prevent drying too fast.

REINFORCEMENT FOR CONCRETE

For heavy construction work involving beams and columns, reinforcement with steel rods is needed. Reinforced concrete is rapidly coming to be the most approved kind of construction of large buildings. Our own great building is one of the most noteworthy examples, being of reinforced con-



DETAILS OF REINFORCEMENT

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crete throughout. For any building where reinforcement seems desirable the following details will be found useful:

Plan of the footing or foundation of each column is shown in *f*; *g*, side view of footing and part of column above. The steel rods that run up through column are shown by dots in *h*, and the wire spiral by diagonal lines in *g*. *h* is cross-section of column filled with cement, the shaded part being the concrete. *a*, section of floor slab, $4\frac{1}{2}$ inches thick; it is also shown on top of the floor girder and floor beam (crossbeams between girders). *b*, girder; *c*, cross-section of girder, the dots showing twisted steel bars that take up the tensile stress—compression stress is carried by the concrete. The steel bars, *d*, stuck into the column at an angle, are to prevent the girders from breaking off or “shearing” at column.

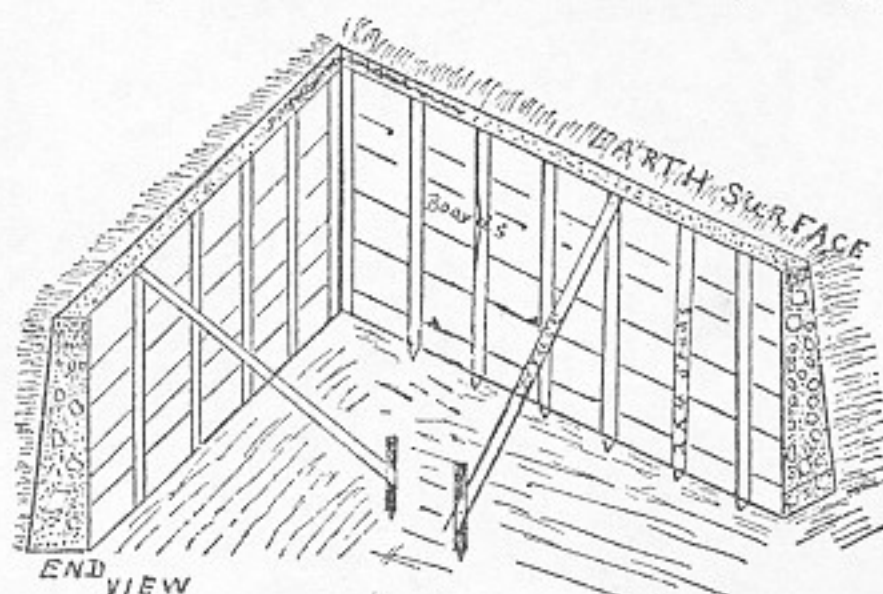
MAKING A FROSTPROOF CELLAR

Some farmers build their own concrete cellar walls and chimneys with inexperienced help. Lay out your foundation the same way you would for any building. Have outside line of excavation plumb. Then use 2 x 4-inch studs the length required. Point one end, drive in ground, on line of inside of cellar wall, brace top of stud by driving stake in ground, and nail brace to stake and each stud. You must make everything firm. Then take square edge boards and place horizontally against the studs. (See illustration.)

Do not try to go around the whole cellar wall, take one side at a time to the height of earth surface, but turn your corner. Pay no attention to outside, let the stone and cement push up against the earth. It is the best plan to finish the whole wall up to the earth surface line before making the

elevation above the ground line.

Above the earth surface line do just the same on the outside as you have been doing on the inside, but now you must use boards and studs, as up to



CONCRETE CELLAR WALL

this point the earth took the place of them. Plumb every stud you drive, and place them 24 inches apart. Have cellar window frames ready and place them as you come to them. Be sure and make extension for hatchway when building your main wall. For the corners use baled hay wire in wads, bending it around the center of wall, and a reinforced concrete corner will be the result.

Get cobblestones or any stone from the size of a goose egg to the size of your head, and put them in bottom of wall to depth of 1 foot. Make a mixing bed, say, about 12 x 36 x 72 inches. One man

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used an old wooden sink as near watertight as possible. Use one water pail of cement to three of fine gravel sand. Put one and one-half pails water in the mixing bed, then add the cement. Be sure and mix water and cement well before using sand. Throw sand in one shovelful at a time. Have one person mixing with a good-sized hoe, while another throws in the sand. Mix well.

Have it about the same as thin mortar, so it will leave the pail easily when pouring into the foundation. Cover the stones and then put in another lot and do the same to height of wall up to within a couple of inches. Do not put stones to full height of wall. To bring wall up to line, mix cement and water together (or one part sand and one cement) so it will run, and after wall is hard pour it on top and it will find its own water level and your sills will fit exactly. It is a good plan to have wall thicker at bottom than at top—perhaps 18 inches at bottom and 12 inches on top.

Now for hatchway steps. Put in the stones, as they save cement. Before the cement gets hard,

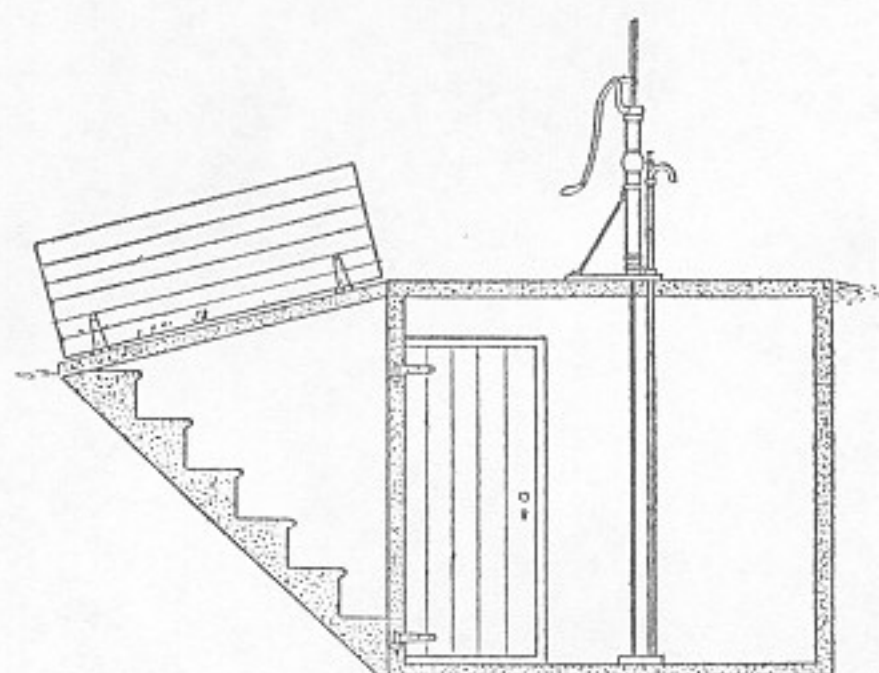
drive in some large spikes, leaving them projecting about 2 inches on line of hatchway sills. Your hatchway doors will stay in place if sills are well-fitted on to spikes. One of the most important things is to be sure of the sand you use. If there is more than 10 per cent loam in the sand, your work will be a failure.

A SUMMER COOL ROOM

A simple method of constructing a cool, outdoor cellar in localities where the common house cellars are too warm for use during the summer time, is shown in the accompanying sketch. It is a cellar

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made under the pump, so that the water pumped by the windmill has a very cooling effect. In places where it is difficult to obtain ice, it will prove indispensable to the dairyman who keeps a few cows. Another important item is the fact that a man does not have to pull up all of the pipes every



CONCRETE OUTDOOR CELLAR

time that he finds it necessary to repair the pipes and pump.

It is constructed of concrete. The top is reinforced with $\frac{1}{2}$ -inch steel rods placed 1 foot apart each way and the concrete work is about 6 inches thick. The sides are made by using a form, and the stairs are also made of concrete and are reinforced by small steel rods. The cost, including the labor, is about \$50. In the west and southwest it will also answer the purpose of a storm cave, which is considered a fixture on all farms.

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A CONCRETE SMOKEHOUSE

The structure is about 8 x 10 feet and 7 feet high. It will keep the meat inside and thieves out.

For a building of this sort 8-inch walls will be thick enough. Excavate to the proper depth below frost, which will be two feet or less, and use a mixture of one part portland cement, three parts sand and six parts gravel or broken stone.

Make the forms of matched boards, although square-edged boards could be used for this purpose. The forms must be well braced and may be raised as the work of laying the wall progresses. Space for a doorway must be left and two eyebolts inserted in the concrete for the door to swing on. The door jamb can be molded in cement if it is desired. An eyebolt for the lock and latch should also be placed in the wall.

The roof will no doubt be of boards or shingles. The plates should be placed on the concrete and held to it with bolts properly imbedded. An arched concrete roof can be made if desired, in which case it will be necessary to leave suitable vents in each end, or build a small flue to allow the smoke to escape. To make the house absolutely proof against fire a steel or iron door should be used.

LAYING A CONCRETE FLOOR

A concrete floor should be level with the top of the sill, where there is much passing in and out with stock or wagons. There should be about 4 inches of concrete. If the earth is leveled off and tamped down hard, it would be unnecessary to put any crushed stone under the concrete in a building

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where frost or water does not get underneath. It is generally recommended to put several inches of stones, gravel or cinders on top of the earth, but many floors are laid without such a bottom. Partitions for horse stalls and cattle stanchions can be held in place on a cement floor by putting down iron belts or pieces of gas pipe when the floor is laid. Let them project 2 or 3 inches above the floor.

MAKING A CONCRETE WALK

The best way is to dig a trench 16 inches deep, put in a foot of loose gravel or stone, leveling it off with fine material. On top of this spread 3 inches of concrete made of one part portland cement, two parts sand and four parts crushed stone or gravel. On this put a granolithic finish 1 inch thick mixed in the proportions of 1-2-3. Trowel it down smooth and hard. Joints $\frac{1}{4}$ inch thick and filled with sand should be left every 5 feet to prevent walk from cracking.

CEMENTING A CISTERN WALL

In making a surface waterproof, a mixture of

about one part portland cement to two of sand will shed water from a roof or wall, but to make a surface perfectly watertight, so that it will keep out standing water, it is better to use neat cement only, that is, cement with no other material but the water with which it is mixed, and it will cost less to put on a coat $\frac{1}{4}$ inch thick of neat cement than one 1 inch thick, one-half or two-thirds sand, as the neat cement mixed with plenty of water is waterproof.

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SPECIAL USES FOR CEMENT

A sack of portland cement is a very useful thing to have for making quick repairs about the farm. A hole in a drain pipe can be stopped in a few minutes with a little cement, mixed with water, thick as putty. A crack in a barrel can be stopped this way. Hardwood floors may be patched and nail holes filled so they will not leak.

A waterproof floor can be laid over an old board floor in a short time. Sweep the old floor clean and dry and nail down all loose boards. Cover with a layer of heavy wire netting, tacking it down occasionally. Over this lay a layer of concrete of one part portland cement, three parts clean sand, mixed with water to a thin paste.

Smooth thoroughly, but if it is to be used by stock, brush with an old broom to make it rough, then let it dry thoroughly before using the floor. Gutters may be put in where necessary. Holes in an old shingled roof can be quickly stopped by forcing a little cement putty under the shingle where the leak appears.

Some special uses to which cement is being put are the making of bee hives, brick for pavement and ordinary foundations, cement shingles for roofing, grain bins in the form of square boxlike and round barrel-like receptacles. The use of this excellent material for farm structures is only just opening up and it is destined to become the most important material for general farm building.

A wooden reinforcement in the center of a concrete fence post is worse than useless. It does not make a bond with the concrete, and thus weakens,

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instead of strengthens, the post. Of course, the same is true of wooden reinforcement of any concrete work.

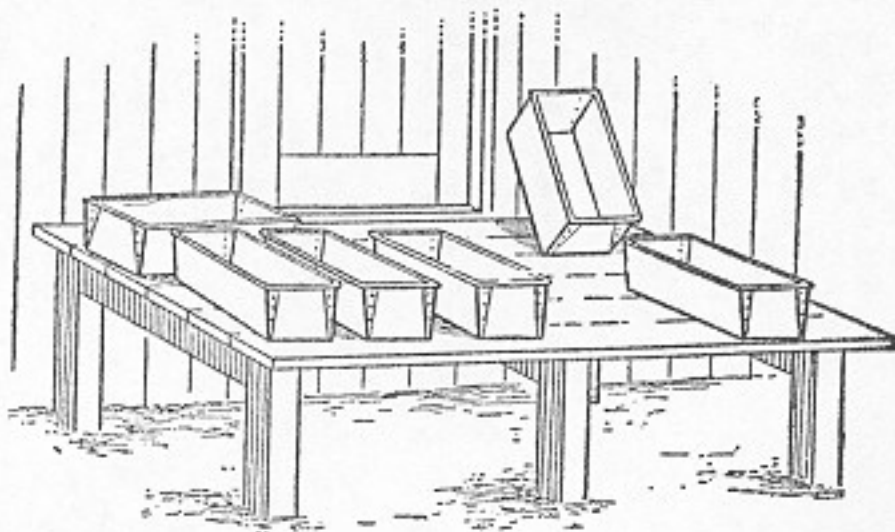
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FREEZING ICE IN BLOCKS



HERE a pond or stream is not handy from which to get the year's supply of ice, blocks can be frozen in forms with comparatively little labor. A supply of pure water is essential. The forms are best made of galvanized iron of any size de-

sired. A convenient size is 16 inches wide, 24 inches long and 12 inches deep inside measure. The sides and ends should be made to taper $\frac{1}{4}$ inch, so



HOMEMADE ICE MOLDS

that the frozen block will drop out easily. The top of the mold should be reinforced with wire for the sake of strength and durability.

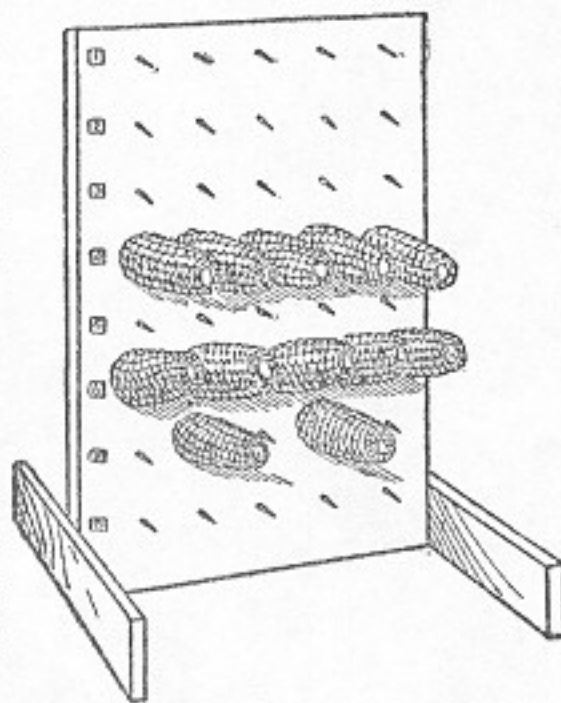
With a dozen or 20 forms one can put up quite a supply of ice during the winter. The forms should

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be set level on joists or boards and placed a few inches apart. Fill them nearly full with pure water and let them freeze, which they will do in one or two days and nights in suitable weather. When frozen solid, turn the forms bottom side up and pour a dipper of warm water on them, which will release the cake of ice. The form can then be lifted off, the ice put away in the icehouse and the form filled with water again.

SAVING THE SEED CORN

Here is a handy device for preserving select ears of seed corn. It consists of a wide board



SEED CORN RACK

fastened between two supports nailed to the edges. The board stands upright on one end and may be as long as desired. Drive heavy spikes through it from the opposite side and stick an ear of corn upon each spike. This allows for the passage of air, and the ears can be examined without removing them from the rack. It

is much to be preferred to expensive wire racks, as each nail may be numbered and a record kept of the ears in this way. This rack was designed at the Idaho experiment station.

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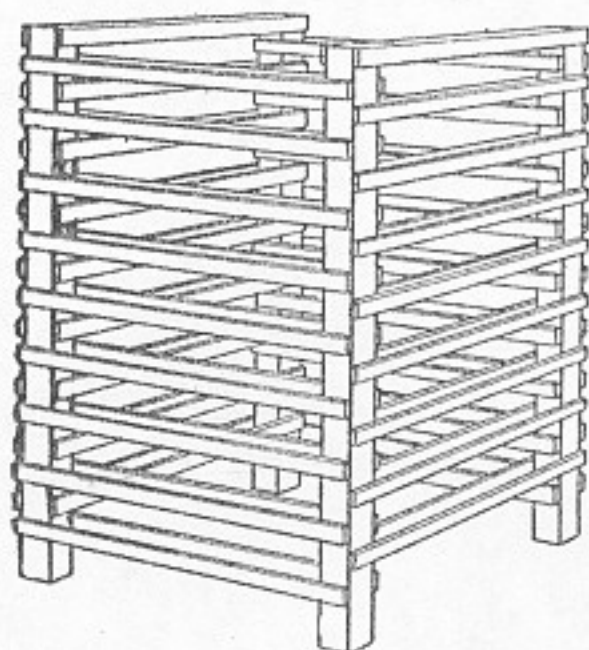
RACK FOR SEED CORN

Here is a simple arrangement for keeping choice ears of seed corn. Take a 2-inch square timber for the upright, and make a solid base by boring a hole through the two base pieces, then drive the timber into it. Drive 4-inch spikes through the upright at intervals of 6 inches from four sides, and stick the ears of corn on these spikes by thrusting the same into the butt of the cob. Numbers may be placed above each spike, so that records can be kept of all of the corn. The corn should be placed on this rack as soon as picked and husked, and may be left there until planting time if the rack is placed in a dry room where rats and mice cannot get at it. A large post strongly mounted on a heavy pedestal may be used in a manner similar to the small upright described above. The bigger the post and the larger the number of spikes used, the greater the capacity of the rack, of course. It is a good plan to make the pedestal heavy and strong in order that it may not be tipped over too easily.

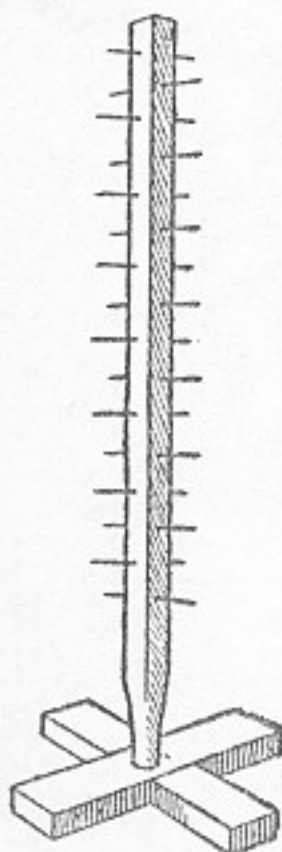
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DRYING AND KEEPING SEED CORN

Never let it freeze before it is dry. Farmers have had seed corn exposed to a temperature of 30 degrees below zero without injuring its vitality, and have had it ruined at 10 degrees above zero. We would not recommend kiln-drying for the general farmer, as this is only practicable where a grower is in the seed business. A very convenient way is to take four pieces 4 x 4 are each 2 inches thick. In using the jack, the axle



CORN DRYING RACK



RACK

6 feet long, set them up in a square, and nail laths on them two and two opposite. Leave a 6-inch space between the laths, so the corn will have plenty of ventilation. Lay your corn on this to dry, and if thoroughly dry it can lay there all winter.

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FIG. 1

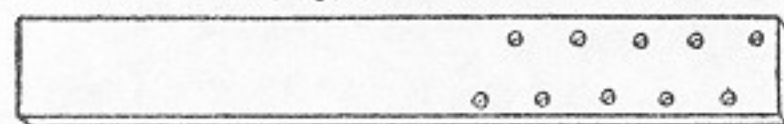


FIG. 2

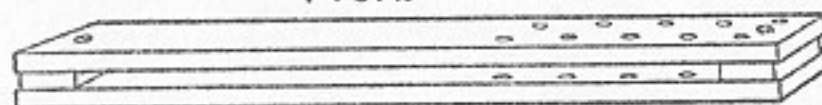


FIG. 3

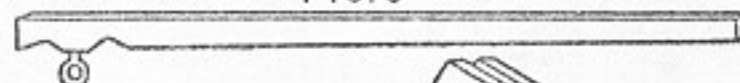
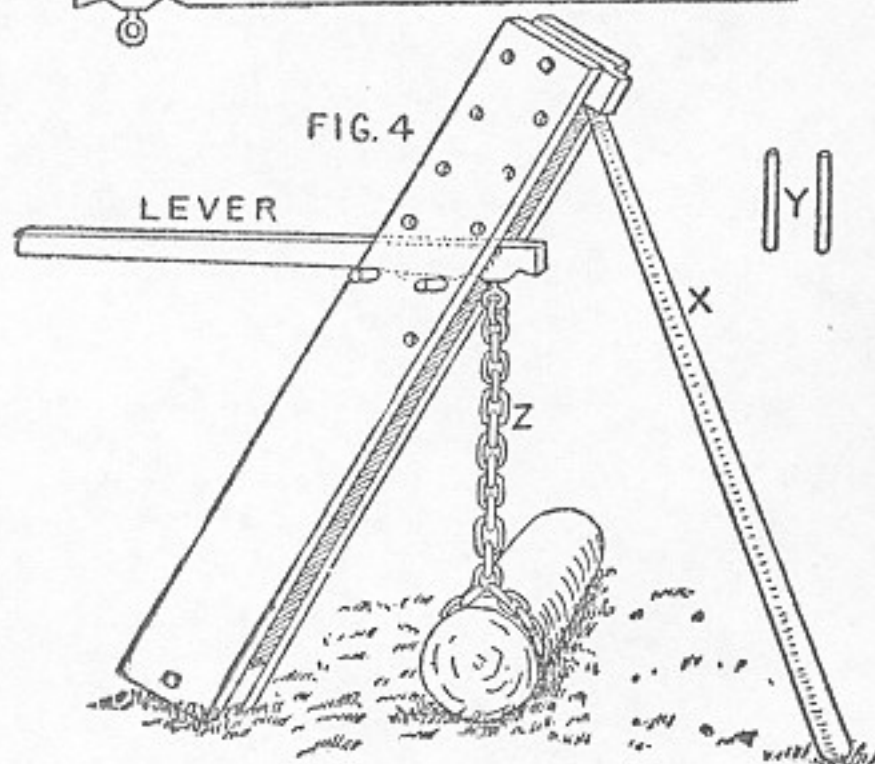


FIG. 4



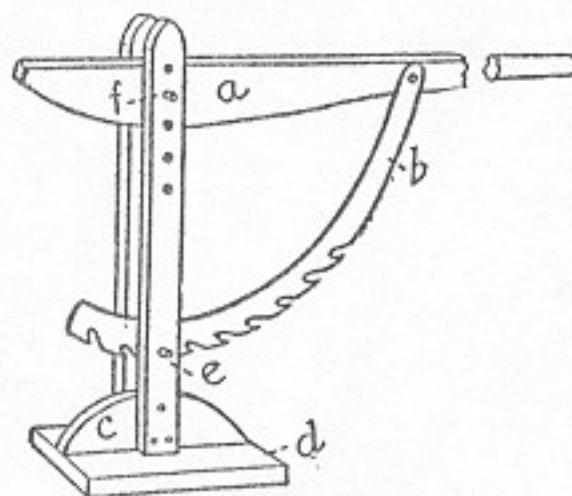
WEIGHT LIFTER AND DETAILS

The drawings show the different parts and one of the many uses of this device.

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STRONG AND SIMPLE WAGON JACK

Here is a good, practical wagon jack suited to almost all kinds of vehicles. The whole thing is made of wood with the exception of the curved piece, *b*, which is of iron and hooks over an iron bolt, *e*. It is well to have a strong 1/2-inch bolt at *f*, so as to support the heavy weight on the lever, *a*. The bottom, *d*, and the piece, *c*,



WAGON JACK

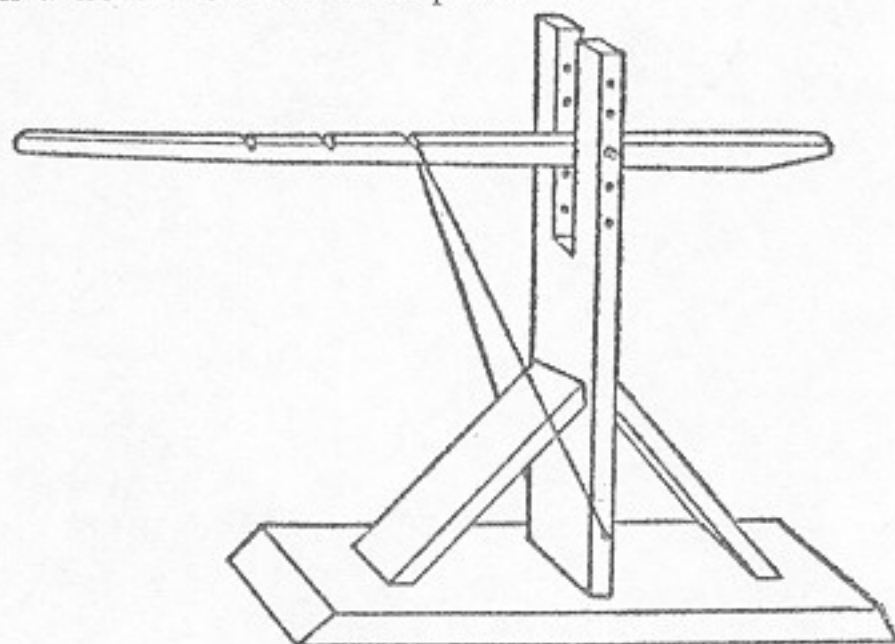
is lifted by simply pressing down on the handle of the lever. The teeth of *b* catch and hold on *e* automatically. The height of lever is regulated by moving *f* up and down.

A JACK FOR HEAVY WAGONS

Many lifting jacks which are designed for light vehicles would not work well in the case of a heavy log wagon. Here is one that will stand a lot of hard usage and is simple and effective. Make the base and upright of heavy 2-inch oak plank and insert a $\frac{3}{4}$ -inch bolt through the lever for a support. Have a good, strong hemp rope attached to the base, pass-

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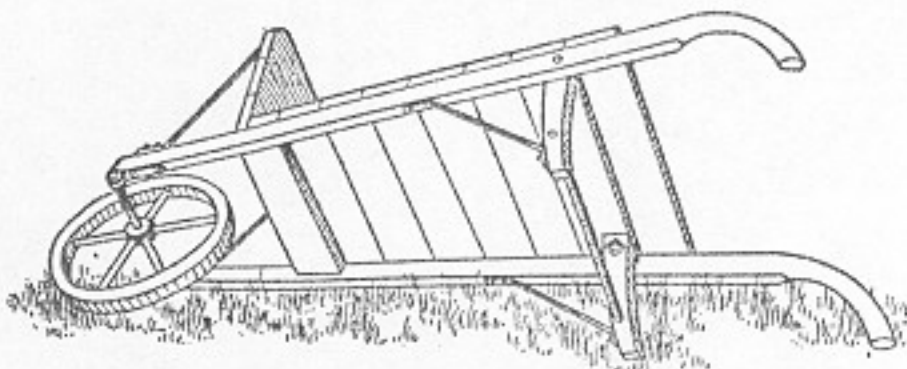
ing over the handle end of the lever, so that as it is drawn down and the wagon is lifted it can be hooked in a notch to hold it in position.



HOMEMADE WAGON JACK

A CHEAP WHEELBARROW

The construction of this barrow is very simple. Get a pair of old plow handles, two gate hinges about 1 foot long, and a wheel, which may be found at the junk dealer's. The legs of the wheelbarrow



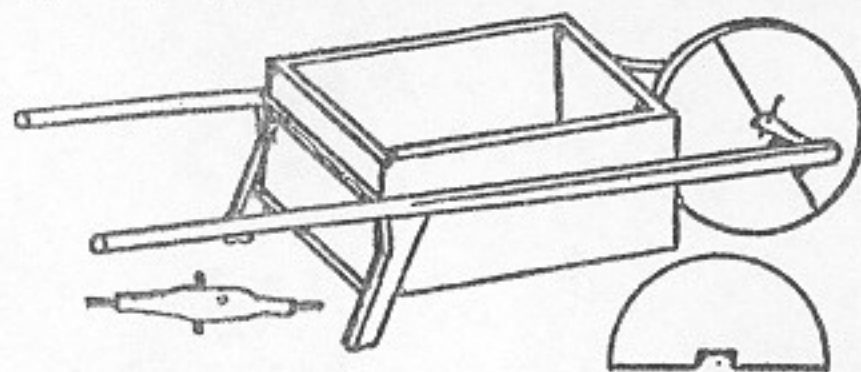
MADE FROM OLD MATERIAL

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are those of an old chair, braced with a piece of iron. These articles in themselves are worthless, but in their combination we create something very useful.

A WHEELBARROW CHEAP AND STRONG

Here is a picture of a handy, strong wheelbarrow that any farmer can make on a rainy day. Take a dry-goods box 30 inches long, 24 or 26 inches wide and 20 inches deep, and two sticks $5\frac{1}{2}$ to 6 feet long and $3 \times 3\frac{1}{2}$ inches for handles. Nail or screw



BOX WHEELBARROW

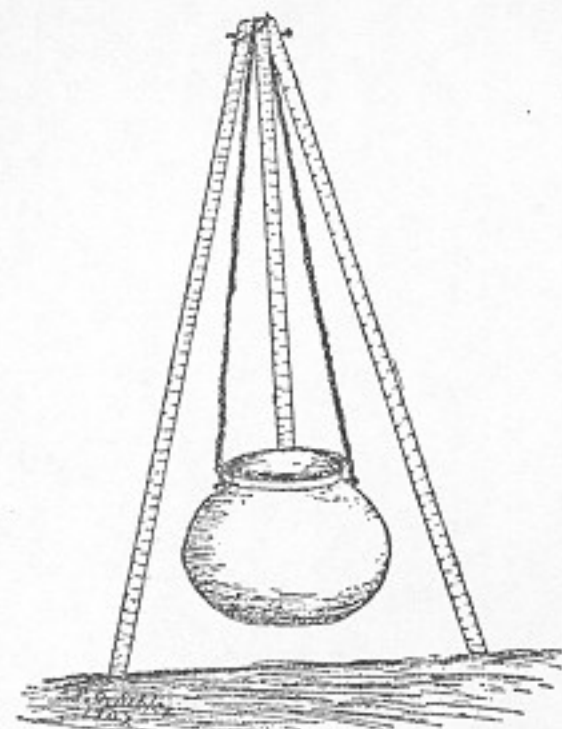
on crossbrace in front and rear, and pieces with brace as shown for legs. Cut four half circles from inch hardwood board and a notch in center to fit around axle. Nail these securely together for the wheel.

For the axle, take a stick $3\frac{1}{2}$ inches square. Trim and band each end or wrap with wire. Bore holes and drive a 6d. wire nail in each end. Just 2 inches apart in center, bore two 1-inch holes on opposite sides to hold the wheel in place. A band of hoop iron around the wheel will make it last longer. When it is put together, you have a very substantial wheelbarrow that cost but little.

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HOW TO HANG A KETTLE

Using stones for a kettle support seems handiest oftentimes, but let the heat crack one of the stones and tip the kettle over, as it frequently will, does not tend to improve a man's language, let alone the loss sustained. It is much better to make a support such as is presented in the cut. The three uprights, of suitable length to correspond with the size of the kettle, may consist of any good wood. Through the top of these a hole is bored for the bolt to hold them together, which must be long enough so they will have play to set



TRIPOD-HUNG KETTLE

up easily. All that is necessary then is to suspend two chains from the top and letting them extend downward to the proper distance, attach the ears of the kettle into the hooks on them. When not in use, the device can be folded together and laid away.

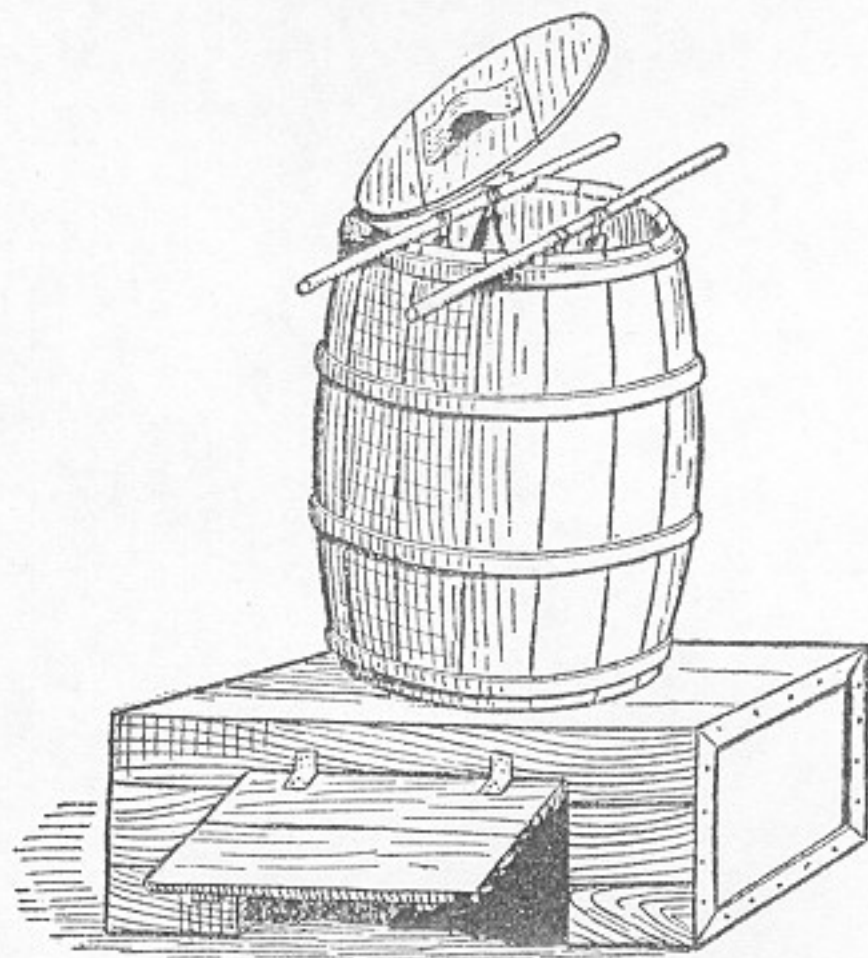
A SNOW PLOW

No person not owning a snow plow can appreciate how useful one is after every storm. A horse, or if the snow be a heavy one, a span or a yoke of cattle and this simple homemade arrangement, and

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in less time than is required to tell it there is a path, and no back-breaking work either. It is only a big V braced so the snow is pushed both ways by it. It must be made of 2-inch planks at least 1 foot wide and not less than 6 feet long. If shorter it wobbles and does not stay on the ground well.

To make a good road for teams, chain it to one side of the wood sled and drive up and down. It spreads 2 feet, and will make your farm front look as if somebody of pluck lives there. For foot-paths draw it from a ring at the top of the front so it will root.



SMOKEHOUSE SUBSTITUTE

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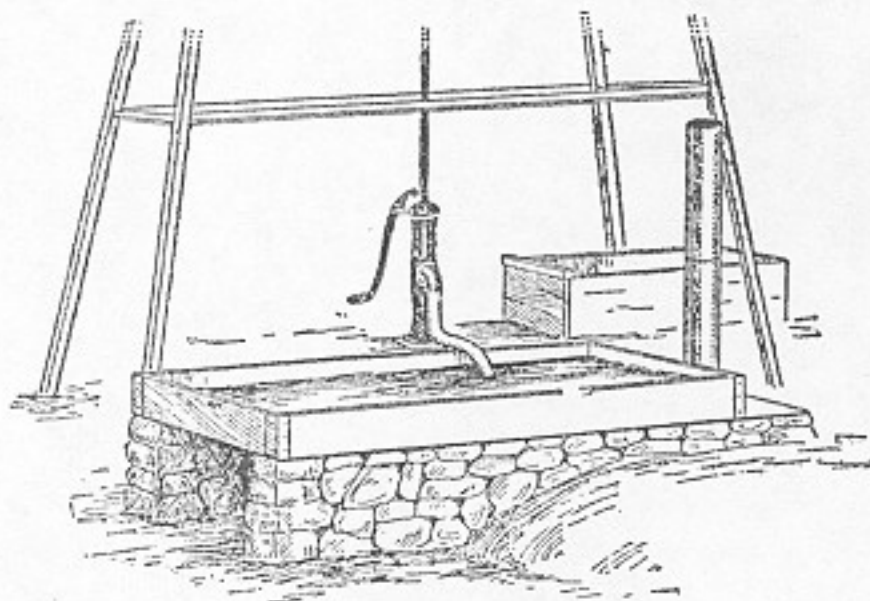
TEMPORARY SMOKING DEVICE

If one butchers only once a year it is not necessary to build an expensive smokehouse, for almost as good results can be obtained from a device such

as that shown on page 242. It is made by taking both ends out of a barrel and mounting it upon a box or above a fireplace in the ground. The meat to be smoked is hung from the sticks laid across the top of the barrel, the fire built underneath and the lid put on.

HOMEMADE HEATER AND COOKER

A cheap and economical heater may be of home construction. Make a frame of 2 x 8-inch pine 7 feet long and 27 inches wide. Put a bottom on



TANK AND COOKER

this of No. 18 galvanized iron, letting it project $\frac{1}{2}$ inch on each side and 14 inches at one end for a stovepipe fitting. Spike the frame together and

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cover the corners with heavy tins to prevent any leaking. Nail the bottom on with two rows of nails.

Make a fireplace on the ground of stone and blue clay or brick and cement of mortar if preferred, 2 feet wide by 3 feet long and 18 inches high. Pile up dirt 1 foot high and 3 feet wide at the end of the fireplace for a flue, put stone on the earth the length of the galvanized iron, place the tank on this foundation and bank it up with dirt. In cutting a hole for the stovepipe, turn up strips of the galvanized iron for a collar, then drive an iron rod into the ground, put on two lengths of stovepipe and wire it fast to the rod.

A piece of sheet iron should be set up before the fireplace to control the draft and keep the fire. Such a heater, on one farm, is located near the windmill and storage tank and can be filled from either. The water can be heated quickly with cornstalks, straw, cobs or brush. One may boil pumpkins and small potatoes for fattening the pigs, and cook ground feed by pouring scalding water on the meal in barrels and covering with old blankets or carpets. A light fire will take the chill from ice water for the milch cows.

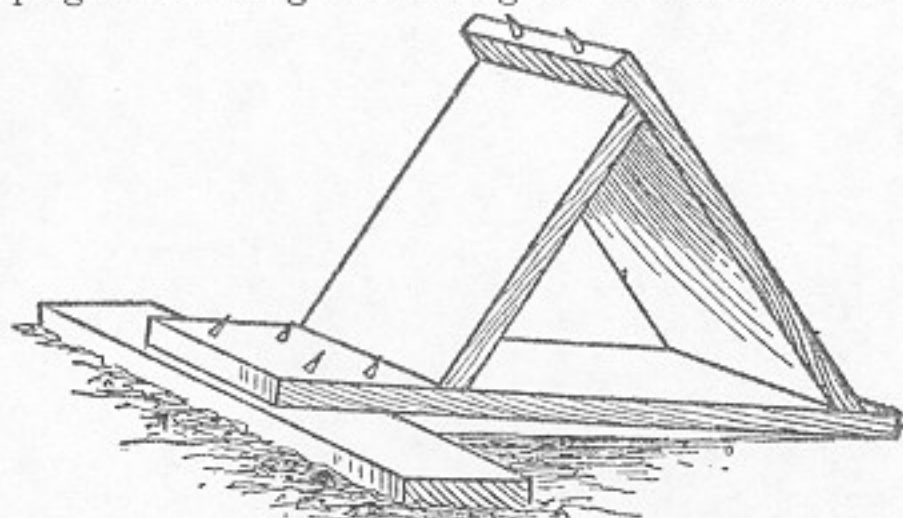
USE FOR A TOUGH LOG

Most farm wood piles have two or three old logs lying about which nobody cares to tackle with an ax or blasting powder, and are too short for the sawmill. If straight, they will make good water troughs. Square the ends, mark off about 10 inches from each end, chop out the inside and trim the edges. An inside coat of oil or pitch tar will increase wearing qualities.

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A HANDY WOOD SPLITTER

For splitting wood a farmer in eastern Massachusetts uses a device as shown in the cut. Take a 2 x 8-inch plank about 3 feet long and an upright of the same material about 20 inches long. Set this upright at an angle of 20 degrees and use a brace of



WOOD SPLITTING DEVICE

the same material. The sharp points shown in the cut are 40d wire nails. Set the wood against these spikes in splitting it.

HOW TO SPLIT WOOD

Wood splits much more readily in the direction up from the root of the tree than when the blow of the ax is downward. In other words, to split a chunk place it upside down—contrary to the direction in which it grew. It is much easier to split by slabs than to try to cleave through the center. This means to split off pieces near the edge.

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A PULLING HAMMER

If you want to make your old claw hammer do more work and do it better and easier, have the handle projecting a little beyond the head. You will find it much more convenient in drawing a nail, as it makes a right angle for pulling the nail without bending it to one side. It takes the place of a block and is always on hand and ready in the right place for immediate use. The handle is simply whittled a little more than usual and driven through



to the required distance. Don't drive it through too far, but about as shown at *a* in the picture. If it sticks out too much, it will be in the way when driving nails. Whittle it off rounding, and give it a finished appearance.

MOUNTING THE FARM ANVIL

To make a solid foundation for an anvil, build a form of boards 14 x 18 inches square at the base, 18 inches high, tapering to 8 x 10 inches at the top. Fill this mold with rich concrete and fix a bolt in the center of the top of it to fasten the anvil. Afterward, melted lead can be poured around the base of the anvil, completing a very nice pedestal.

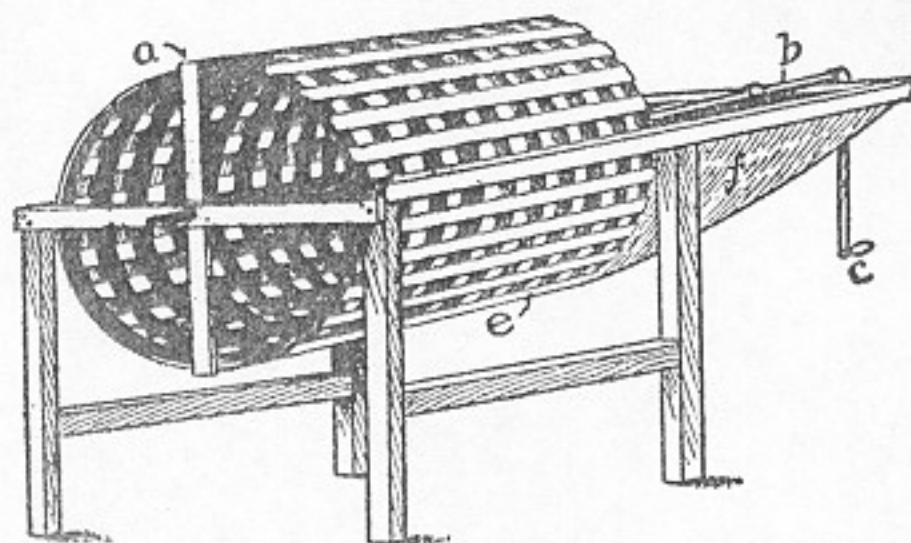
SORTING POTATOES QUICKLY

The sketch shows a homemade potato cleaner and sorter. It consists of a number of hoops to which are fastened $\frac{1}{2}$ -inch slats so as to make holes

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$1\frac{1}{2}$ inches square. Two heavy pieces, *a*, are placed inside the cylinder to hold the axle, *b*, which extends entirely through the machine and is turned by a crank, *c*. The frame made is 4 inches lower at the opening end of the cylinder so that the potatoes will run through freely.

At the crank end is a hopper, *f*, into which the potatoes are poured. The cylinder is $2\frac{5}{8}$ feet long



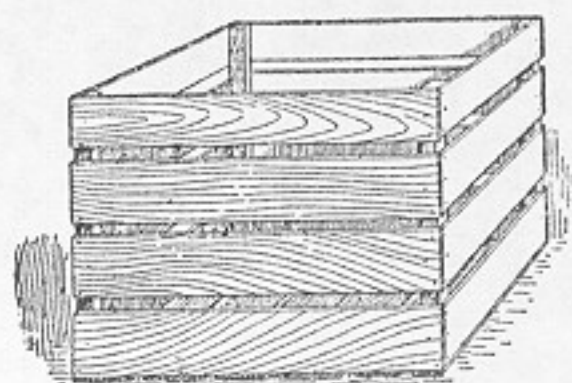
POTATO SORTER AND CLEANER

and 3 feet in diameter. It will not bruise the potatoes, and the dirt and small ones run through on to the floor or crate and the marketable ones run out at the open end of the cylinder into another crate. With one man to turn the crank and another to fill the hopper, from 700 to 800 bushels can be sorted in a day.

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HANDLING POTATOES EASILY

A bushel crate is often more convenient to use in handling ear corn, potatoes or other vegetables



STORAGE BOX

than a basket. Crates that will hold a bushel when level full may be piled upon one another and thus stored in less space than baskets. At the same time they can be just as easily and just as quickly moved. They may be of light material. Pieces of wood 2 inches square are used for the corner posts. The slats may be made of $\frac{1}{2}$ -inch boards 3 inches wide nailed securely to the corner posts. There should be just room enough between the two upper slats so that the fingers can be inserted when lifting the box. The box will be more durable if the upper slats are an inch thick. A handy size for the completed box is 16 inches long, 14 inches wide and 12 inches deep, outside measurements.

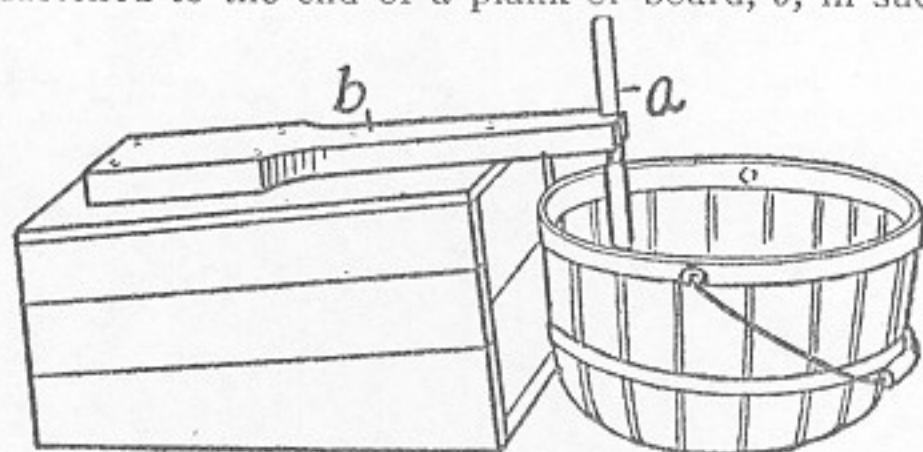
CUTTING SEED POTATOES

In the principal potato growing sections, medium to large seed is used for planting and cut to two eyes. In the famous Greeley district of Colorado, cutting is done by hand. Potatoes are shoveled into a bin or hopper, made of a dry-goods box raised on legs. The back is made higher than the front, so that potatoes will run down to the open-

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ing and the bottom is slatted to let out the soil shoveled up with the potatoes.

The cutting is simple. An old case knife, *a*, is fastened to the end of a plank or board, *b*, in such



SEED POTATO CUTTER

a way that potatoes can be pushed against the knife and fall from it into the basket beneath. The operator sits on the box to which the board is fastened and can work very rapidly.

ANOTHER SEED POTATO CUTTER

A wide bench is boxed in on both ends and one

side. It is divided into two or three compartments, these being open in the front which corresponds to the side boxed in. To each of the compartments is attached a sack on hooks, and along one side of the bench in the middle of each compartment and right over the opening of the sack is fixed, in an upright position, a shoemaker's or common steel table knife.

Potatoes to be cut for planting are shoveled into the compartments of the box and in front of each compartment a man takes his position, being seated

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on a box or stool for comfort's sake. He seizes the tubers in rapid succession and by pulling them against the blade quickly cuts each one into as many pieces as desired; the pieces are then dropped into the open sack. It is claimed that by this indirect method of using the knife two fairly good cutters can cut each day all the potatoes ordinarily required for the use of one planter.

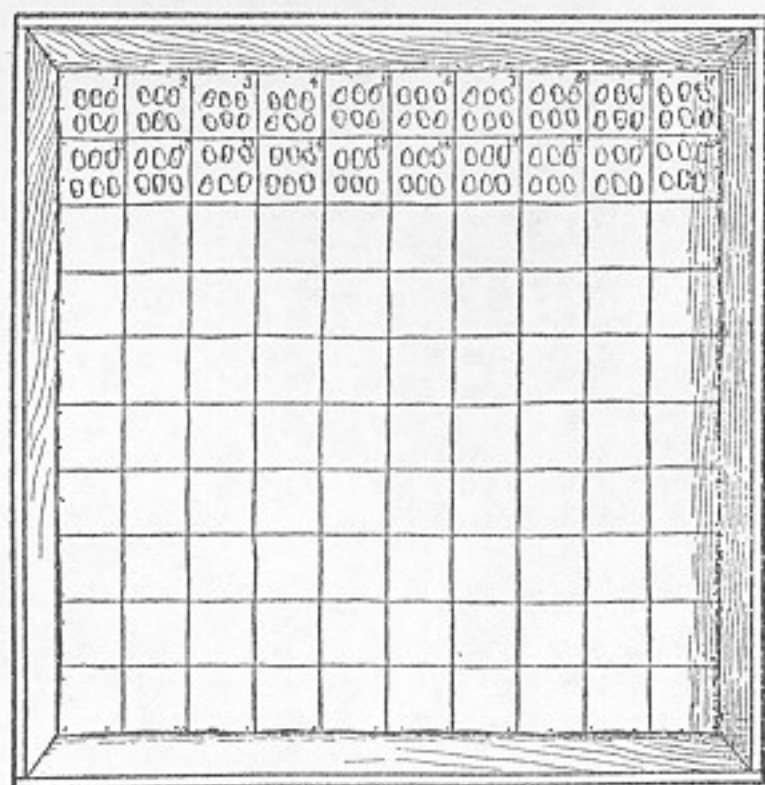
HOW TO TEST SEED CORN

Of the different methods for testing seed corn, the most convenient and satisfactory is a shallow box provided with wet sawdust to furnish the moisture and a marked cloth on which to lay the kernels. The most convenient box is one 2 feet square. This will accommodate 100 ears. It is best to make it about 6 inches deep. Fill a sack half full of clean sawdust and soak it for three or four hours in water. Then spread this sawdust in the bottom of the test box to the depth of 1 inch. Take a smooth brick and pack the sawdust down all over the box, making it as level as possible. Be sure to get it packed firmly around the edges and in the corners.

Then take a piece of white muslin 25 inches square. Stretch this tight on a table so that it can be marked. Rule off on this cloth with a heavy blue pencil 100 squares 2 inches each way. Beginning at the upper left-hand corner number these squares in rotation from left to right. When the ruling is done, pack the cloth in the germination box so that it will rest firmly on the sawdust. This can be done by pointing the tacks in the edge of the box downward, and as the tack is driven in it will draw the cloth tight over the sawdust.

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Of course, there is no advantage testing any ears that are of undesirable shape or conformation, therefore the first step is to pick out those nearest to the type wanted. Lay these out in rows upon a plank or upon the floor, separating each ten ears with a nail driven into the plank or floor. Starting at the left-hand end of the row call the first ear No.



GERMINATION BOX

1, then the first ear beyond the first nail will be No. 11, the one beyond the second nail No. 21 and so on.

Remove six kernels from ear No. 1 and place them in square No. 1 in the test box. Put six kernels from ear No. 2 in square No. 2 and so on through the row. In removing the kernels from the ear take a pocketknife in the right hand and the ear in the left. Place the blade at the side of the

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kernel you wish to remove and pry it gently. The kernel will come out easily and should be caught in the palm of the left hand. First remove a kernel from near the butt of the ear; turn the ear a quarter turn in the hand and remove a kernel from the center; turn the ear another quarter turn and remove a kernel from near the tip; another quarter turn and remove a second kernel from near the butt; another quarter and remove the second kernel from the center; another quarter turn and remove a second kernel from the tip. This makes six kernels from six different rows and representing the butt, middle and tip.

In placing the kernels in the box it will be found of advantage to point the tips all in the same direction, and also to lay the kernels with the germ uppermost. If the kernels are laid in the squares promiscuously, they may be thrown out of their places when the sprouts begin to grow. When the kernels are all in place, take a second piece of white cloth fully 24 inches square, moisten it and lay it carefully over the kernels. This will hold them in place while the top layer of sawdust is being put on. Take a third piece of cloth about 48 x 30 inches and lay it over the box so that the edges lap about equally. Then in this cloth put another inch

of wet sawdust and pack it down firmly, especially around the edges. When this is done turn the edges of the cloth over the sawdust to keep it from drying out too rapidly and place the test box where it will not be subjected to cold below a living-room temperature.

Reading the Results

After seven days carefully roll back the cloth containing the top layer of sawdust and lift the

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second cloth off the kernels. This must be done with care, because sometimes the sprouts grow through the cloth and the kernels will cling to it.

Observe the results in square No. 1. If all six of the kernels have vigorous sprouts, from $\frac{3}{4}$ to 2 inches long, you can be sure that ear No. 1 is thoroughly good. If in square No. 2 only two of the kernels have sprouted, you may know that ear No. 2 will make much better hog feed than seed corn. As soon as you have determined that ear No. 2 is really bad, pull it out from the row about half its length, leaving the other ears in place. After you have gone through the whole line, you may then go back and pick out the bad ears and discard them.

Of course, we would all prefer to use only those ears that gave a perfect germination, and if one has enough, that is the thing to do. But experience has taught that it is quite safe to use an ear, four of whose kernels grow strong sprouts. Or, if seed corn is scarce, one should not hesitate to use one that gave three strong sprouts and two weaker ones.

This testing may be done at any time after the ears are dry. It is generally more convenient to do it in winter, when there is not much outside work to be done. The box may be set behind the stove or any other convenient place, where it is sufficiently warm; in many cases, where there is an attic above the kitchen that room is a sufficiently warm place for testing.

Some put sand in an ordinary dinner plate, flood with water, and then drain the excess water off, place the seed on top of the sand, and cover with another dinner plate. Others use a saucer made

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of porous clay. The seeds are placed in this, the saucer set in a pan of water, and the pan covered.

These methods may be used for other grains as well as corn. In case of sowing grasses, alfalfa or wheat, it is often of great advantage to test the seed.

KILLING INSECTS IN GRAIN

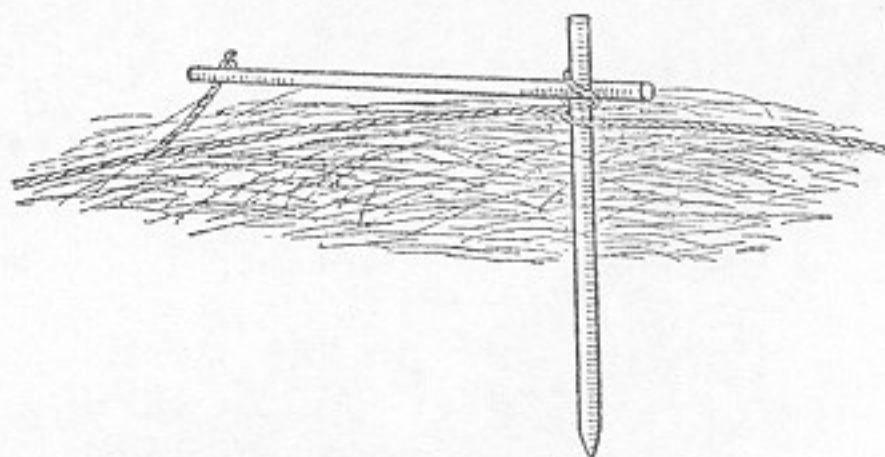
If one has not time to make a substantial box for fumigation of seed grain for insect destruction, barrels may be utilized for the purpose. Get two tight, strong barrels, such as coal oil barrels, and make water tight. Put in the seed to be fumigated, cover with a blanket and close-fitting cover. Before covering pour carbon bisulphide, which is explosive, over the grain, at the rate of 3 to 4 ounces for 5 bushels of grain. If it is not desirable to pour this poison on grain, set a saucer on it, and pour the poison in the saucer. Place a small block near the saucer to hold up the blanket 1 or 2 inches higher, lay blanket over the

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barrel, and place cover securely in place and weight with stone. This will kill the weevil in peas and beans.

BINDING PINS FOR HAY

Every person moving hay ought to have a set of binding pins. They are made in a minute and serve an excellent purpose for a lifetime. The sketch shows a rope stretched over the top of a load of hay or straw. The upright pin is worked down into the load and the other twisted in the rope and turned around the upright until the load



BINDING LOAD OF HAY

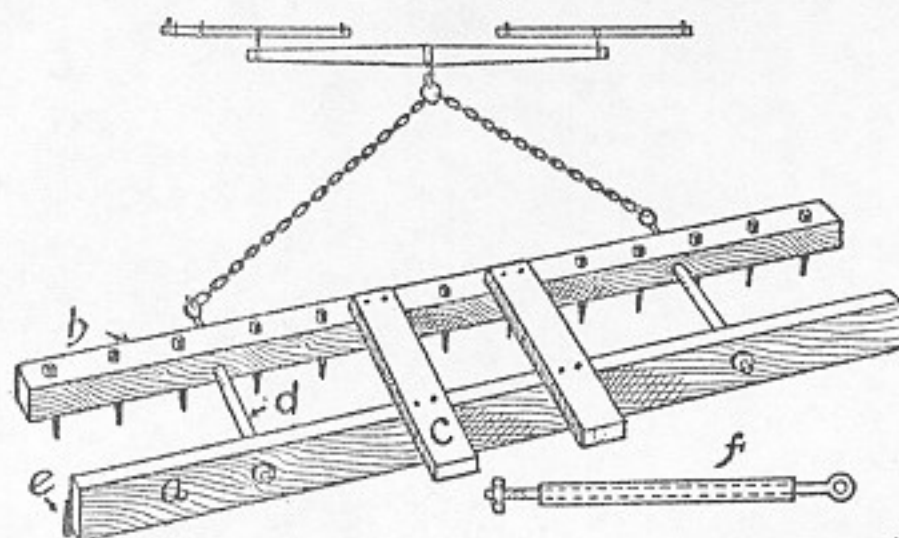
is tightly bound. Then a small rope that is kept tied in end of the horizontal pin is tied to the binding rope and the pressure is held. Each pin is $3\frac{1}{2}$ feet long. One is sharpened and the other has a $\frac{1}{2}$ -inch hole bored through one end. Old fork handles are just the thing to make them of. One pin only may be made and a fork used to bind in the manner shown after the load is on.

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COMBINED DRAG AND HARROW

This road drag is all right. The front piece consists of a 4 x 4 oak strip, *b*, 10 feet long, through which are driven ordinary harrow teeth about 3

inches apart. This is attached to the rear piece, *a*, which is a 2 x 6 oak timber 10 feet long faced with



HARROWS AND LEVELS AT ONCE

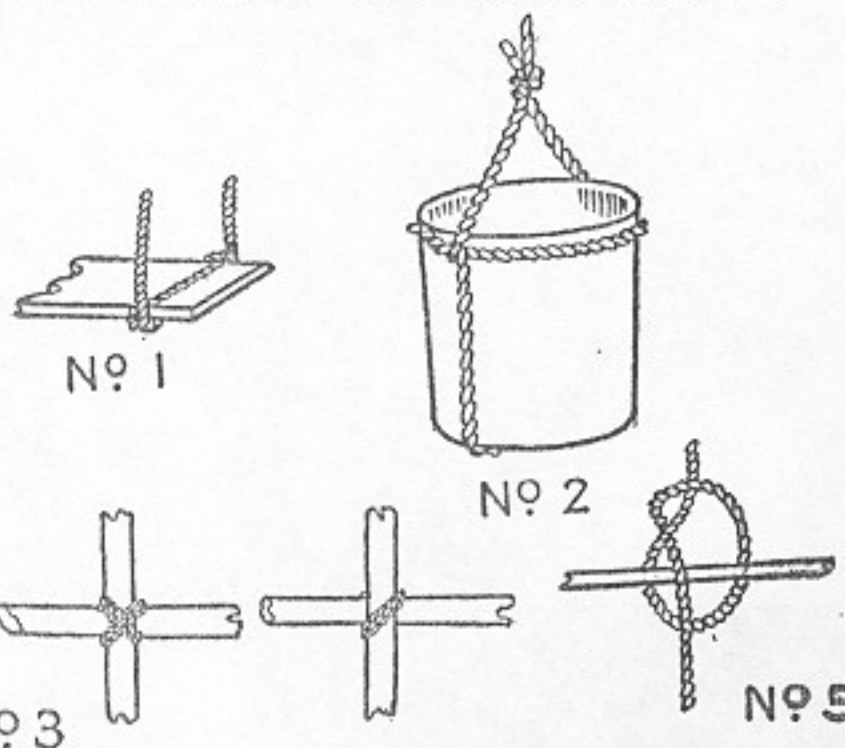
3 inches of $\frac{1}{4}$ -inch metal on the bottom, *e*, which projects 1 inch. These pieces are kept apart by wooden blocks, *d*, upon the bolts, *f*, and by the top strips, *c*, each 2 x 6. This makes a fine level road, as it harrows it and scrapes it at the same time.

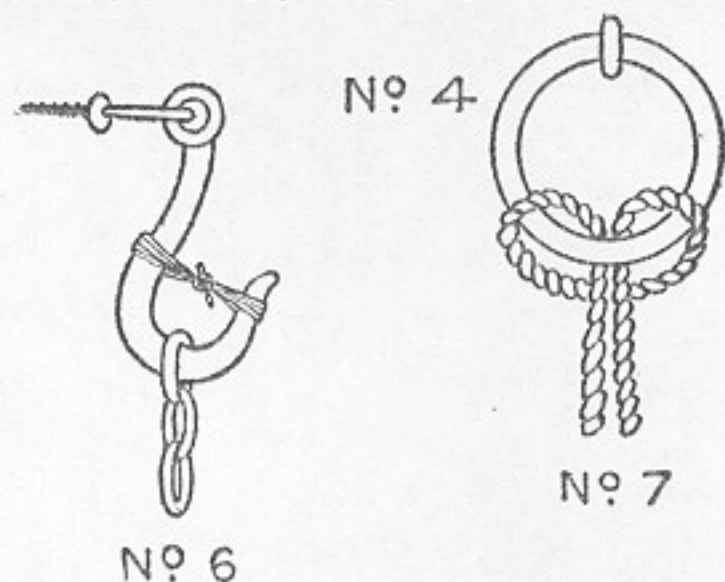
HOW TO HANDLE A ROPE

A rope is one of the most useful articles that are constantly needed about the farm; but too many farmers are not familiar with the many uses to which the rope may be put. The various sailors' knots may often be used to great advantage. To sling a plank for painting or other purposes make

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a bight of rope as shown in Figure 1, bringing the rope entirely around the plank, so as to prevent its turning and throwing the workman down. One-half to $\frac{3}{4}$ -inch rope is usually sufficient for all practical purposes. A hemp rope is more generally used and stands wear better than other kinds.





SOME ROPE HITCHES

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A useful way to sling a can or pail from the end of a rope is shown in Figure 2. Prepared in this way the vessel is secure so long as the rope is not slipped off from the bottom. Secure the knot firmly at the top to allow no slipping and so that the pail may not become lopsided.

Scaffolding may often be erected by tying poles together as shown in Figure 3. This sort of lashing will not slip if made tight. In many cases a chain may be used as shown in Figure 4, in which case the weight should be on the side of the upright where the chain is lowest. All of these lashings must be drawn very tight so as not to allow any play, which may result disastrously.

An excellent hitch knot is shown in Figure 5, readily made, easily loosened and valuable for many purposes on the farm. This knot is readily untied by slackening up the drawing strand. It does not become tight and hard as many ordinary knots after heavy usage.

In many cases where heavy hooks are used they are liable to come unfastened unless a cord is affixed, as shown in Figure 6. A few turns of heavy twine or light wire in the middle will frequently prevent any loosening of the chain.

A ring hitch, shown in Figure 7, is a very effective and safe method, which may be made on short notice. The loose end of the rope is allowed to hang free or may be tied with a slip knot to the drawing strand.

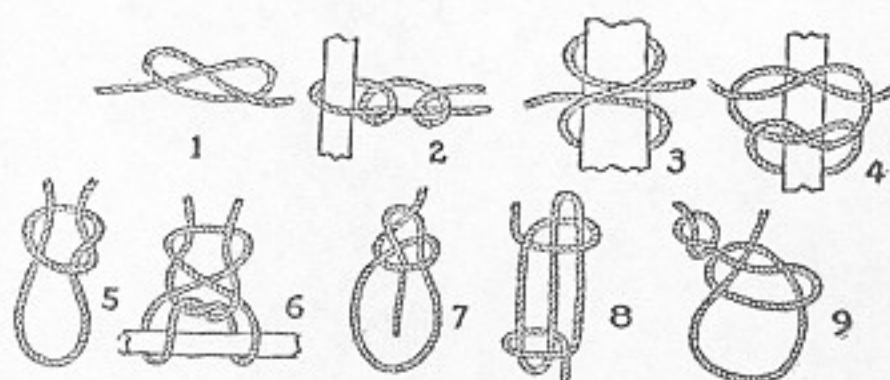
TYING SOME USEFUL KNOTS

A sailor judges knots for their holding qualities and also their ability to be quickly unfastened, without regard to the strain they have been sub-

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jected to. A knot's main office is to hold, without working loose or slipping, yet they do occasionally fail absolutely to accomplish this, when made by

inexperienced hands. The accompanying diagrams show some of the simpler knots that may be of everyday use. In these, the mode of formation can be readily discerned, because the rope's position is shown before tightening. The overhand knot, Figure 1, is probably the simplest of all. It is used only for making a knot at the end of a rope to keep it from fraying or to prevent another knot from slipping. If a slight change in formation is



A FEW GOOD KNOTS

made, as in Figure 5, it develops into a slip knot or, as it is sometimes called, a single sling, and its purposes are obvious. A double sling is represented in Figure 6, and though it is slightly more complicated, it is considerably more useful for any purpose where a rope is to be attached to a bar or beam and stand a steady strain.

Probably for convenience and emergencies no knots equal the bow-line, Figure 7, because it will not slip or give, no matter how great the tension; in fact, the rope itself is no stronger, and the instant the strain ceases it can be untied as easily as

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a bow. When the end of a rope is to be secured, the two half-hitches or clove hitch, Figures 2 and 3, are of great importance, for either of these bends can be attached instantly to almost anything, and their holding powers are exceeded by none. The square knot, Figure 4, can be used for infinite purposes, from reefing a sail to tying a bundle, the advantage being, if made properly, of resisting any separating strain on either cord, and yet can be untied immediately by pulling one of the short ends.

One of the best and safest slip knots is shown in Figure 9, made with the overhand at the end, which, until loosened by the hand, maintains its grip. When a rope requires shortening temporarily the sheep shank, Figure 8, affords a means of so doing. This knot can be applied to any part of the rope without reducing its strength of rectilinear tension.

CARRYING A BARREL MADE EASY

In the cities the ash collectors use a simple device,

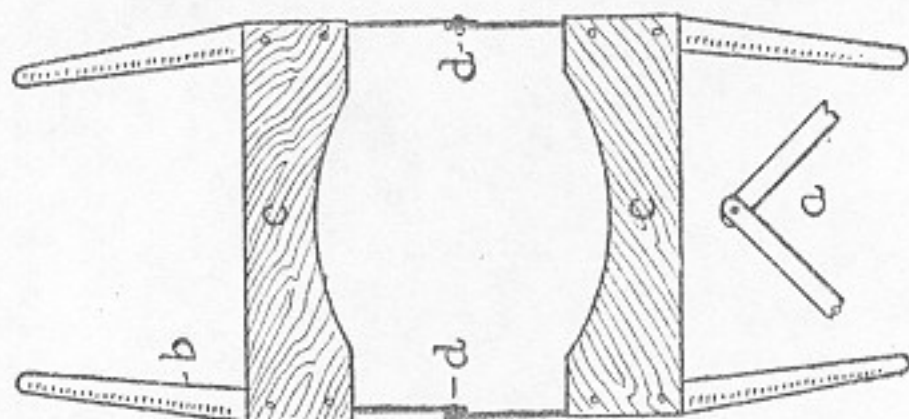
which farmers might make and often find handy, as barrels often become dried, weak and will not stand rough handling. The device is made of six pieces of wood; four pieces are about 2 feet long and 4 inches in thickness and width. Handles may be whittled on one end of each. About 10 inches from the other end, boards about 2 feet long and 8 inches wide are nailed as shown at *c, c*, in figure. Pieces *c, c*, are then cut in circular form so as to fit the outside of a barrel.

An old wheel tire may be straightened and four pieces cut to be fastened to the ends of each of the four handle pieces, as at *d*. These are then riveted

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together so as to make hinges as shown at *d, d*. The tire need be only long enough to fasten securely to the handle pieces. Of course, the blacksmith should drill holes in them, that they may be securely riveted.

To use this device, drop it over the barrel. One man lifts on the two front handles and another



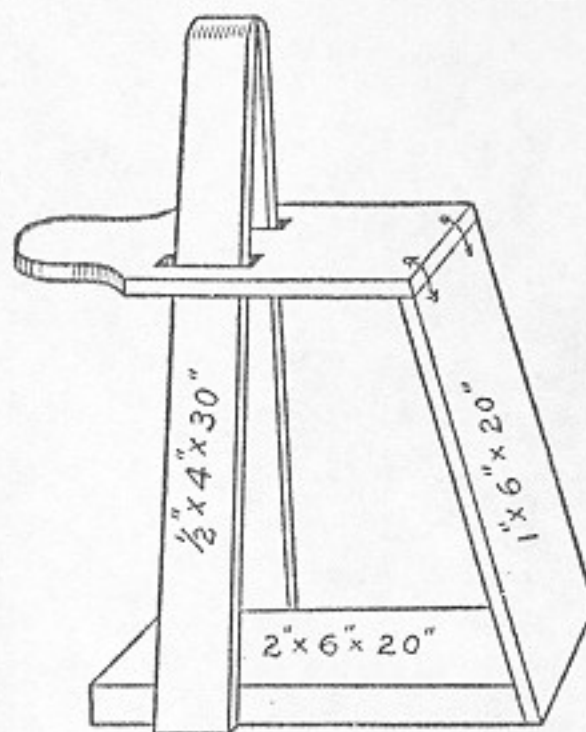
BARREL CARRIER

man on the rear handles. Boards *c, c*, close up in circular form, just beneath the lowest hoop round the upper end of the barrel, and cling tightly. The barrel is then lifted and readily carried without jar to its contents or straining the barrel. Of course, if all the barrels on the farm are of uniform size, the device could be made without hinges, and the barrels headed up could be rolled on pieces *c, c*.

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HARNESS CLAMP

The accompanying drawing represents a very handy harness mender which anyone who can use a saw and hammer can make in a few minutes. It is made of lumber of the dimensions indicated in the drawing. The clamp is tightened by the worker



THE CLAMP

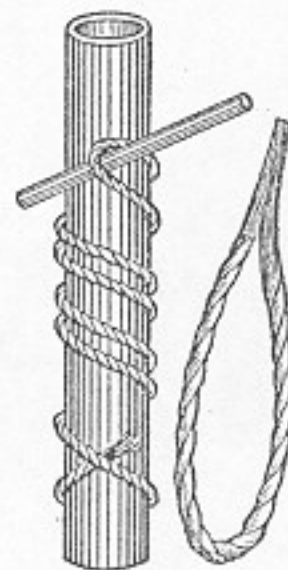
sitting upon the seat, which should extend at least 2 feet from the clamps. The drawing shows the device with a shorter seat than that. It would doubtless be bet-

ter to have the seat extended to twice the length shown from the left of the clamps and to have the base extended in a similar manner, so that the device will not tip over too easily. The joint at the upper right-hand corner may be hinged with heavy wire run through holes and twisted together underneath, or real strap hinges of iron may be attached.

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SUBSTITUTE FOR PIPE WRENCH

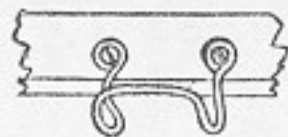
The drawing shown here illustrates a useful device for twisting pipe off or on its connections. Three or 4 feet of new rope is frayed out at both ends, which are put together and wound tightly around the pipe to be turned, so that the first coil twists over the loose ends and continues around the pipe, two or three times, ending in a loop, through which a bar of iron is slipped, to be used as a lever. This simple plan will be found very effective in ordinary requirements for the pipe wrench, and is worth a trial. A more durable wrench may be made by using wire instead of rope. The loop can be formed by closely twisting the ends of the wire with pincers. The rope is rather easier to handle because more flexible.



PIPE TWISTER

MARKET WAGON CONVENIENCES

Farmers who regularly haul produce to market or deliver direct to customers will find the conveniences described to be of much value. They save much time and considerable trouble and cost but little effort to make them. Instead

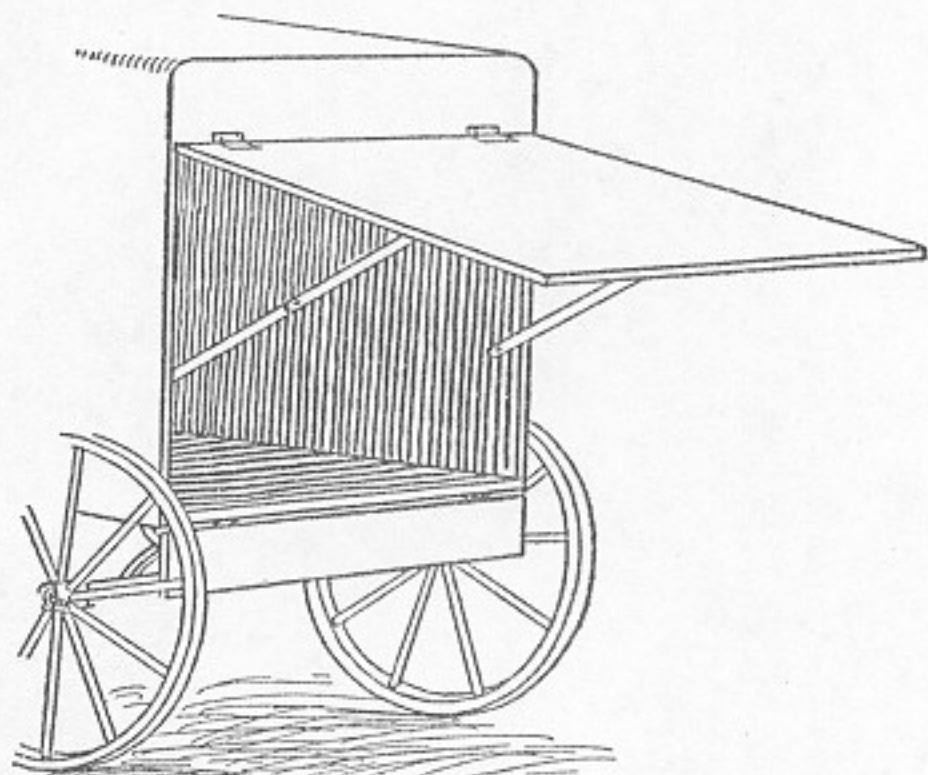


REIN CLIP of wrapping the reins about the whip, or letting them lie over the dashboard, a hook, such as shown in the first sketch, may easily be made of stiff fencing wire and secured to the top of the wagon or the dashboard.

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Two other hooks may be arranged at the sides of the wagon to hold an umbrella, which would be kept there rain or shine, and never forgotten and left at home. This will save a drenching some time and perhaps some valuable produce.

Another convenience is a rear curtain of oilcloth stretched over a light board frame and hinged at



REAR SHADE FOR WAGON

the top, as illustrated. Two old stays from a buggy top will serve to support it, when it must be left open, and it will protect the driver from sun and rain while taking things from the wagon.

CARRYING BUTTER TO TOWN

A refrigerator that one farmer uses in which he takes butter to town nine miles away in hot weather

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is made thus: Get two clean, tight boxes of some odorless wood, one 12 x 15 x 13 inches deep, and the other 9 x 12 x 10 inches deep. Slip one inside the other with a notched block in each corner to hold the inside box in place. Fasten the covers together so as to leave an air space of about 1 inch between them all around. The inner box will hold 20 pounds of butter nicely. It will carry butter solid in wagon all day in 90-degree weather.

TO SHARPEN SCISSORS

Do you know that you can sharpen scissors, and easily, by passing the blades over glass jars? Take a bottle or jar, make believe you are trying to cut it (have one blade in and the other outside of the top of the bottle) and then allow the scissors to glide off the hard surface naturally, just as if you were trying to cut the glass. Use firm but not too hard pressure, and repeat the operation several times.

HOW TO PAPER A ROOM

If a room has been papered several times, tear off all the loose parts you can and with a sponge and water loosen what remains on the walls, removing as much as possible, so as to have a smooth, even surface. If the room has never been papered, first go over it and fill all large cracks and holes with a paste made of whiting and water, or plaster of paris and water. When using the latter, mix only a little at a time, have it rather thin, and use quickly. Then, give the room a coat of sizing, which is made of common glue, three or four handfuls dissolved in a pail of boiling water. The sizing is applied with a large brush and should be allowed to dry overnight.

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Choose Judiciously



HANGING WALLPAPER

For very sunny rooms, select cool-looking papers, such as blues, greens and browns in various shades, while for dark rooms pinks, reds, terra cottas and yellows are best. When selecting papers, pay care-

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ful attention to the color scheme of your room, and don't have an inharmonious mixture, which will offend good taste. Small, plain patterns are the most economical, and the easiest to match. The cheap, trashy papers, costing only a few cents a roll, are not worth the trouble of putting up. Gold paper is not to be recommended for wear.

No borders should be used for rooms having a low ceiling. For such, a striped paper of pretty design running right up to the ceiling is best. The ceiling may be papered in a plain or very small-patterned design, to harmonize with the side walls, or treated with several coats of tinted kalsomine or paint. A picture molding of appropriate color is used to finish the side walls, being placed scarcely 1 inch from the ceiling. The ceiling whether papered, painted or kalsomined, should be done first. It is a very difficult matter to paper the ceiling, and, unless you can have help, it would be better not to attempt it. Plain tints in paint or kalsomine are always pretty and in good taste. If, however, you want to risk papering the ceiling yourself, get some handy body to help you.

Paste and Tools

The paste is made by simply boiling flour and water together, and adding a very little alum, salt and glue—about a tablespoon of each to a pound of flour. It should be of a consistency thick enough to apply easily, and not so thin that it will run.

Provide yourself with a good-sized paste brush, another one (a whitewash brush will do) to use dry over the paper, sharp scissors and a knife,

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plenty of clean rags, two barrels, two long, smooth, clean boards, each about 10 inches wide, and a step-ladder.

Make a long table by placing the two barrels about 8 or 9 feet apart and on top of these the boards.

Trimming and Cutting

The first thing to do is to cut the necessary number of strips of paper long enough to allow for waste in matching, and lay them all face downward on the "operating" table, one on top of the other. Next spread the paste evenly over the top or first

strip of paper, being very sure to have the edges well pasted. Then turn top and bottom parts down, bringing pasted sides together, so that they meet, and none of the paste part is exposed, and carefully trim off edge on one side, with large, sharp scissors. Lift up the part thus trimmed and folded, and mount the ladder, which should previously have been placed convenient to the place where you intend to begin operations—the largest wall space is best, next to a door or window.

Hanging the Paper

Now take hold of the top end which was doubled over (it will open and hang by its own weight) and adjust to its proper place on the wall. Then, with a large clean rag in your hand, rub downward, never up or sideways, and take great care to keep the edge straight. If you find that you didn't start straight from the top, loosen paper and do it over again. A "straight eye" is needed to do the work neatly. Don't rub too hard and always rub down-

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ward, doing a little part at a time, and lifting paper occasionally, so that no air bubbles are left under it. When the upper part is done, dismount from ladder, undo the folded part at the bottom of the width, and proceed in the same manner to adjust to the wall. When you are sure it is on straight and smooth, trim with a sharp knife along the base-board. Then give the strip another smoothing by going all over it again with a dry, clean brush. Proceed in this way until all the full length parts are covered, and then match in the small spaces over and below windows and doors. All the matching must be done with great care.

Practical and Economical

Wainscoting in living or dining rooms are nice, and very practical, especially where there are small children. For this purpose burlap, or the less expensive dark, heavy papers that come in wood-grain imitation are good. Matting is sometimes used with very good effect, too. A narrow wooden molding is used to finish the top of the wainscoting, and in that case the work of papering the side walls is so much easier, the lengths being short.

THE FARM BLACKSMITH SHOP

A blacksmith shop is of immense practical value on a farm. To those who have one it is almost as essential as live stock, farm tools and crops. One does not need to be a professional blacksmith. The elementary practice in welding, upsetting and tem-

pering is easily learned with a little practice. Nor is it necessary to have many tools. An entire equipment may cost but a few dollars.

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An old railroad rail will do for an anvil. But after getting the real article one is better satisfied and can do the work with greater ease. The forge should be obtained at the start. With it almost anyone can heat any small iron to welding point with as much ease as a regular blacksmith.

In the equipment of an Ohio farmer are a pair of tongs that he made himself, two other tongs and a large pair of pinchers picked up in a junk shop. He got the hammer and sledge from a hired man who had worked in a car shop. The anvil and vise also came from the junk shop, and both were in good repair. These cost \$8, the hammer and sledge, \$1.15, and an old, second-hand forge, \$1.80. Not a large outlay to be sure, but a wise expenditure. If purchased at first hand the cost would be greater, but cheap at any price when you consider what you can do in the way of making and repairing with such a list of blacksmith tools.

In addition to the above list this man, Frank Ruhlen, has chisels, pinchers, fullers and other small tools, all of which he has made out of old pieces of steel taken from old worn-out machines. By figuring and planning just a little, any farmer can make the greater part of his own tools and at a very small cost for materials and labor.

Why the Shop Pays

Mr. Ruhlen says: My shop was not started to replace the town blacksmith shop; and it will never do so. But it does serve for repair work, and it saves many trips to town. It is helpful in other ways, also. Last winter a sudden ice spell came on, so severe that I could not get the horses out to the field to feed the flock. Only one thing was

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possible: to have sharpened shoes put on the horses. But it was a disagreeable trip ahead to walk and lead the horses to town; so I decided to do the work myself. I had never set a shoe myself, but that trip before me quickly decided. The horses were brought into the shop, the old shoes pulled off and sharpened, and within an hour the feeding was done. Had I gone to town for the work it would have required time going and coming, and then, maybe a long wait ahead for my turn at the shop.

Last year I sharpened the shoes on the corn planter, and both cultivators, six shovels each. We wore out a steel point or shear, and never had it

to shop but once, and then it was to get a new nose or point. I do not try to put steel points on anything, as it is too particular work for anyone who just picks tools up when something breaks. A sharp harrow is a luxury on most farms, because the average smith does not draw the teeth out enough, and they are dull in a few days.

And I do not believe the average smith can harden the farm tools as good as a farmer who has had some experience in tempering, as the farmer is the one who works with the tools, and soon learns when they are too hard or not hard enough. I sharpened my smoothing harrow last year before we commenced on our corn crop of 64 acres, used it on all the land, on some more than once, and my harrow is sharper now than my neighbor's, who paid \$1.50 at the shop for the same work. We never use a dull mattock or pick now as we did before we had a forge. Welding chains, making chain hooks, open rings, clevises, are all easy to do on rainy days. I could not tell all the different uses I make of my shop.

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Blacksmithing Not Hired Man's Work

I do the work in the shop myself, finding other chores for hired men. You cannot afford to break them in, for the reason that they may soon leave and all the teaching and trouble would be for nothing. By doing the work myself, I have learned a little more each year, have acquired the knack of it, and really enjoy doing what is to be done. Had we had a shop when I was a boy all of the repair work could have been done by the boys, and I would at the same time have had splendid training for my own needs now.

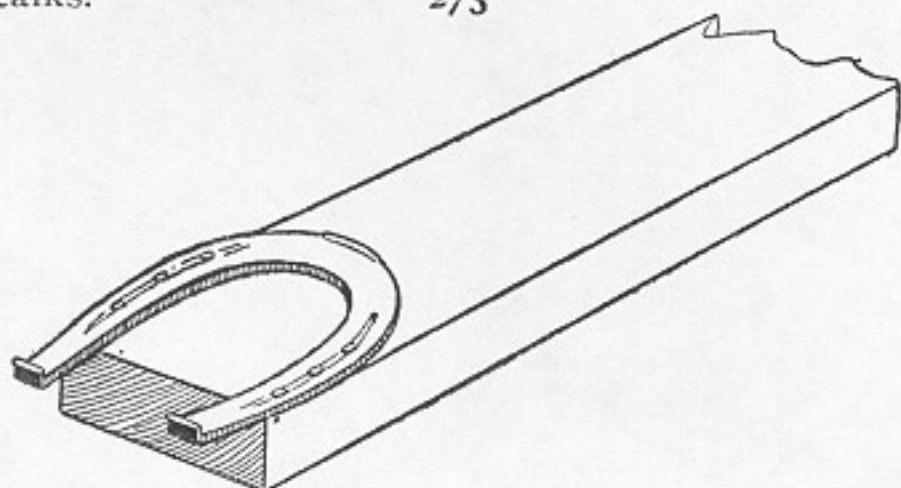
My experience is all in favor of the shop on the farm. It pays well. Get the forge first, and then gradually add other tools as you can. I used a claw hammer for some time before getting a smith's hammer. I did not equip my shop all at once. Start in a small way, build up gradually, learn slowly, and the shop will develop itself. Get a shop, and you will believe in it because of its help to you.

HORSESHOE LEVER

A handy lever for prying up boxes or barrels may be made by nailing an old horseshoe on the end of a 2 x 4, letting the ends of the horseshoe extend about an inch or two beyond the end of the timber. A more finished device may be constructed by cutting the upper part of the lever down to the

form of a rounded handle. A horseshoe should be selected with fairly long and well-sharpened heel calks.

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HORSESHOE FOR A TOOL

HOW TO PAINT TIN ROOFS

Remove all rosin and other loose substances from seams and have roof clean. Paint immediately after laying is finished; do not allow the tin to rust—you coat the base plate with tin and lead to prevent rust, and paint the finished goods to prevent oxidation of the coating. Use only the best red or brown oxide of iron, mixed with pure linseed oil all raw, or half raw and half boiled. Use litharge only as a drier. Litharge makes paint adhere hard to coating, so that when thoroughly dry you cannot scrape it off. Don't use any turpentine or patent driers.

Apply all paint with hand brushes and rub in well. This is very important. Don't put paint on thick—one coat that covers well, and is thoroughly rubbed in, is better than three put on thick. Let roof stand two weeks to a month before applying second coat. Six months or so after applying second coat put on a third coat. After this you do not have to paint roof more than once every two or three years. Too much paint injures a tin roof.

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Keep paint well stirred up; put on thin and rub well in. By following these directions you will have a roof that will last many years.

PRESERVING WOOD

Creosote, or sulphate of copper or iron, are effective for preserving wood. There are objections, however, to their use for floorings or ornamental woodwork. Creosote leaves a permanent, disagreeable smell. The sulphates discolor the wood. Borax is excellent for keeping wood from decay. The preparation of it is simple, and consists in immersing the wood in a saturated solution of borax, which is then heated to 212 degrees Fahrenheit. The

wood is left for 10 or 12 hours, the time depending upon the density and size of the pieces of wood. When taken out, the wood is stacked until dry, then reimmersed in a weaker solution of the borax for a brief time, dried again, and are then ready for use. Boards thus prepared are practically indestructible from rot, and are nearly incombustible.

Another preservative is a compound of one part silicate of potassa and three of pure water—the wood to remain in the solution 24 hours, then dried for several days, then soaked and dried a second time and afterward painted twice with a mixture of one part water-cement and four of the first-mentioned mixture. Thus prepared, it will not decay in the ground, and will be incombustible out of it.

Another process for preventing decay of wood is by use of a paint which possesses the advantages of being impervious to water. It is composed of 50 parts of tar, 500 parts of fine white sand, 4 parts

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of linseed oil, 1 part of the red oxide of copper in its native state, and 1 part of sulphuric acid. The tar, sand and oil should be first heated in an iron kettle; the oxide and acid are then added very carefully. The mass is thoroughly mixed and applied while hot. When dry, this paint is as hard as stone.

Decay in wood may be prevented by the following method: Take 20 parts of resin, 46 parts of finely powdered chalk, some hard sand, and a little linseed oil and sulphuric acid; mix and boil for a short time. If this is applied while hot, it forms a kind of varnish, thereby preserving the wood.

TO PRESERVE SHINGLES

Following is an effective method to prevent the decay of shingles: Take a potash kettle or large tub and put into it one barrel of lye of wood ashes, 5 pounds of white vitriol, 5 pounds of alum, and as much salt as will dissolve in the mixture. Make the preparation quite warm, and put as many shingles in it as can be conveniently wet at once. Stir them up with a fork, and, when well soaked, take them out and put in more, renewing the preservative solution when necessary. Then lay the shingles in the usual manner.

After they are laid, take more of the preservative, put lime enough into it to make whitewash, and, if any coloring is desirable, add ocher, Spanish brown, lampblack, or other color, and apply to the roof with a brush or an old broom. This wash may be renewed from time to time.

Salt and lye are excellent preservatives of wood. Leach tubs, troughs and other articles used in the

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manufacture of potash never rot. They become saturated with the alkali, turn yellowish inside and remain impervious to the weather.

TO RENDER WOOD FIREPROOF

Rendering the woodwork of houses secure against catching fire can be done at an insignificant cost, and with little trouble. Saturate the woodwork with a very delicate solution of silicate of potash as nearly neutral as possible, and when this has dried, apply one or two coats of a stronger solution.

Another method is simply to soak the wood with a concentrated solution of rock salt. Water-glass will act as well, but it is expensive. The salt also renders the wood proof against dry rot and the ravages of insects. Still another method is to immerse the wood in a saturated solution of borax, heat being gradually applied until the solution reaches 212 degrees Fahrenheit. It is then left for 10 or 12 hours, according to the nature and size of the wood.

FIREPROOF WASH FOR SHINGLES

A preparation composed of lime, salt and fine sand or wood ashes, put on like whitewash, renders the roof 50 per cent more secure against taking fire from falling cinders, in case of fire in the vicinity. It pays the expense a hundredfold in its preserving influence against the effects of the weather. The older and more weather-beaten the shingles, the more benefit derived. Such shingles generally become more or less warped, rough and cracked; the application of the wash, by wetting

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the upper surface, restores them at once to their original form, thereby closing up the space between the shingles, and the lime and sand, by filling up the cracks and pores in the shingle itself, prevents warping.

PETRIFIED WOOD

Mix equal parts of gem salt, rock alum, white vinegar, chalk and Peebles' powder. After the mixture becomes quiet, put into it any wood or porous substance, and the latter becomes like stone.

HOW TO SEASON WOOD

Boiling small pieces of non-resinous wood will season them in four or five hours—the process taking the sap out of the wood, which shrinks nearly one-tenth in the operation. Trees felled in full leaf

in June or July, and allowed to lie until every leaf has fallen, will then be nearly dry, as the leaves will not drop off themselves until they have drawn up and exhausted all the sap of the tree. The time required is from a month to six weeks, according to the dryness of the weather.

BLEACHING WOOD

Sometimes it is more feasible to bleach a small part of a wood surface, especially in repairing, than to darken a larger portion of the work. This can be done by brushing over the wood a solution composed of 1 ounce oxalic acid in a pint of water, letting it remain a few minutes and then wiping dry. The operation may be repeated if necessary. A few drops of nitric ether, or a quarter of an ounce of tartaric acid, will assist the operation; or

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a hot solution of tartaric acid may be used alone. Lemon juice will also whiten most woods. Cut the lemon in half and rub the cut face upon the wood.

When the bleaching has been done and the wood is dry, give a thin coat of shellac or French polish, as the light and air acting upon the bare wood will bring back the original color.

If the wood obstinately resists bleaching, it may be lightened by mixing a little fine bismuth white, flake white or ball white (the cleansing balls sold by druggists) with the shellac, and give it a thin coat. This whitens, but it also somewhat deadens or obscures the grain and is, therefore, not so good as the bleaching method.

WOOD POLISH

Rub evenly over the wood a piece of pumice stone and water until the rising of the grain is cut down; then take powdered tripoli and boiled linseed oil and polish to a bright surface.

FURNITURE POLISH

Take equal parts of sweet oil and vinegar, mix, add a pint of gum arabic finely powdered. This will make furniture look almost as good as new and can be easily applied, as it requires no rubbing. The bottle should be shaken, and the polish poured on a rag and applied to the furniture.

SIZE STAINS

By the aid of glue in the solution, the colors are fixed in size stains. They are employed for the

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purpose of giving a color to cheap work in soft woods, such as chairs, bedsteads and common tables and ordinary bookcases. The colors usually wanted are walnut, mahogany, cherry color, oak and even a rosewood.

For Mahogany.—Dissolve 1 pound of glue in a gallon of water, and stir in $\frac{1}{2}$ pound venetian red, and $\frac{1}{4}$ pound chrome yellow, or yellow ocher. Darken with the red and lighten with yellow, as desired. If the venetian red does not give a sufficiently dark look put in a pinch of lampblack. Apply hot.

For Rosewood—Same as mahogany, omitting the yellow, and using $\frac{3}{4}$ pound venetian red (or more) instead of $\frac{1}{2}$ pound. Give one coat of this and then add lampblack, one pinch, or more, to the color; with the latter put in the figure or dark parts of the rosewood.

For Oak—In a gallon of glue size (as above) put $\frac{3}{4}$ pound powdered burnt umber. Lighten with yellow (chrome or ocher), if need be. Hot.

DARK WOOD STAIN

White woods may be given the appearance of walnut by painting or sponging them with a concentrated warm solution of permanganate of potassa. Some kinds of wood become stained rapidly, while others require more time. The permanganate is decomposed by the woody fiber; brown peroxide of manganese is deposited, which afterward may be removed by washing with water. The wood, when dry, may be varnished, and will be found to resemble very closely the natural dark woods.

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RED STAIN FOR WOOD

Boil chopped Brazil wood thoroughly in water, strain it through a cloth. Then give the wood two or three coats, till it is the shade wanted. If a deep red is desired, boil the wood in water in which is dissolved alum and quicklime. When the last coat is dry, burnish it with the burnisher and then varnish.

LIQUID GLUE

Dissolve 1 pound of best glue in $1\frac{1}{2}$ pints of water, and add 1 pint of vinegar. It is ready for use.

CEMENT FOR METAL AND GLASS

Take 2 ounces of a thick solution of glue, and

mix it with 1 ounce of linseed-oil varnish, and half an ounce of pure turpentine; the whole is then boiled together in a close vessel. The two bodies should be clamped and held together for about two days after they are united to allow the cement to become dry. The clamps may then be removed.

CEMENT FOR BROKEN CHINA

Stir plaster of paris into a thick solution of gum arabic till it becomes a viscous paste. Apply it with a brush to the fractured edges, and draw the parts closely together.

CEMENT FOR CROCKERY AND GLASS

Take 4 pounds of white glue, $1\frac{1}{2}$ pounds of dry white lead, $\frac{1}{2}$ pound of isinglass, 1 gallon of soft water, 1 quart of alcohol, and $\frac{1}{2}$ pint of white

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varnish. Dissolve the glue and isinglass in the water by gentle heat if preferred, stir in the lead, put the alcohol in the varnish and mix the whole together.

MENDING GLASSWARE

Broken dishes and glassware may be easily mended as follows: Fit the pieces in their proper places and tie a string around the vessel to keep the parts from slipping out. Then boil the entire dish for two or three hours in sweet milk. This will firmly glue the vessel together and it will last for years with proper care.

ARMENIAN CEMENT

This will strongly unite pieces of glass and china, and even polished steel, and may be applied to a variety of useful purposes. Dissolve five or six bits of gum mastic, each the size of a large pea, in as much rectified spirits of wine as will suffice to render it liquid; and, in another vessel, dissolve as much isinglass, previously a little softened in water (though none of the water must be used), in French brandy or good rum, as will make a two-ounce vial of very strong glue, adding two small bits of gum galbanum of ammoniacum, which must be rubbed or ground till they are dissolved. Then mix the whole with a sufficient heat. Keep the glue in a vial closely stopped, and when it is to be used set the vial in boiling water.

JAPANESE CEMENT

Thoroughly mix the best powdered rice with a little cold water, then gradually add boiling water until a proper consistence is acquired, being par-

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ticularly careful to keep it well stirred all the time; lastly it must be boiled for one minute in a clean saucepan or earthen pipkin. This glue is white, almost transparent, for which reason it is well adapted for fancy paper work, which requires a strong and colorless cement.

ROOFING PREPARATION

Take 1 pint of fine sand, 2 of sifted wood-ashes, and 3 of lime ground up with oil. Mix thoroughly, and lay on with a painter's brush, first a thin coat, and then a thick one. This composition is not only cheap, but it strongly resists fire.

FIRE KINDLERS

Take 1 quart of tar and 3 pounds of resin, melt them, bring to a cooling temperature, mix with as much sawdust, with a little charcoal added, as can be worked in; spread out while hot upon a board, when cold break up into lumps of the size of a large hickory nut, and you have, at a small expense, kindling material enough for one year. They will easily ignite from a match and burn with a strong blaze, long enough to start any wood that is fit to burn.

MENDING PIPES WITH WATER ON

Many farmers have had trouble in repairing pipes where the water could not be shut off conveniently. A lead pipe which has been cut off accidentally in making an excavation, for instance, may be repaired by the following plan: The two ends of the pipe are plugged, and then a small pile of broken ice and salt are placed around them; in five minutes the water in the pipe will be frozen, the

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plugs removed, a short piece of pipe may then be inserted and perfectly soldered. In five minutes the ice in the pipes may be thawed and the water set to flowing freely again.

TO JOIN WATER PIPES

Water pipes may be united by using a preparation made by combining four parts of good portland cement and one part of unslaked lime mixed together in small portions in a stout mortar, adding enough water to permit it to be reduced to a soft paste.

WELDING METALS

Welding together two pieces of metal of any kind can be accomplished only when the surfaces to be

joined are equally heated, and both surfaces must be brought to such a temperature that the particles will form a perfect continuity between the pieces united. This embraces the entire theory of welding, soldering or brazing metallic substances of any kind. In addition, however, to the equal and adequate heating of the surfaces to be united, every particle of coal dust, cinders or scales of oxide must be removed, so as to present two perfectly clean surfaces at the very moment when the union is to be effected.

The piece of metal that would fuse at the lower temperature must be the guide, when bringing the surfaces of conjunction up to the proper heat. If, for example, two pieces of wrought iron are to be welded, the part that will melt at the lower temperature must be brought just to a welding heat, and the surface of the other piece must be heated quite

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as hot, or a trifle hotter than the first piece. Then, if the surfaces are clean when the parts are brought together, the union will be satisfactory. The degree of heat aimed at must be, not to produce a fluid, but simply to bring the metal into a condition between the fluid and plastic.

GRINDING TOOLS

All steel is composed of individual fibers running lengthways in the bar and held firmly together by cohesion. In almost all farm implements of the cutting kind the steel portion which forms the edge, if from a section of a bar, is welded to the bar lengthwise, so that it is the side of the bundle of fibers hammered and ground down that forms the edge. So, by holding on the grindstone all edge-tools, as axes, scythes and knives of strawcutters, in such a manner that the action of the stone is at right angles with the edge, or, this is to say, by holding the edge of the tools square across the stone, the direction of the fibers will be changed, so as to present the ends instead of the side as a cutting edge. By grinding in this manner a finer, smoother edge is set, the tool is ground in less time, holds an edge a great deal longer, and is far less liable to nick out and to break.

Plane irons should be ground to a level of about 35 degrees—chisels and gouges to 30. Turning chisels may sometimes run in an angle of 45. Molding tools, such as are used for ivory and for very hard wood, are made at from 50 to 60 degrees. Tools for working iron and steel are beveled at an inclination to the edge of from 60 to 70 degrees, and for cutting gun and similar metal range from 80 to 90.

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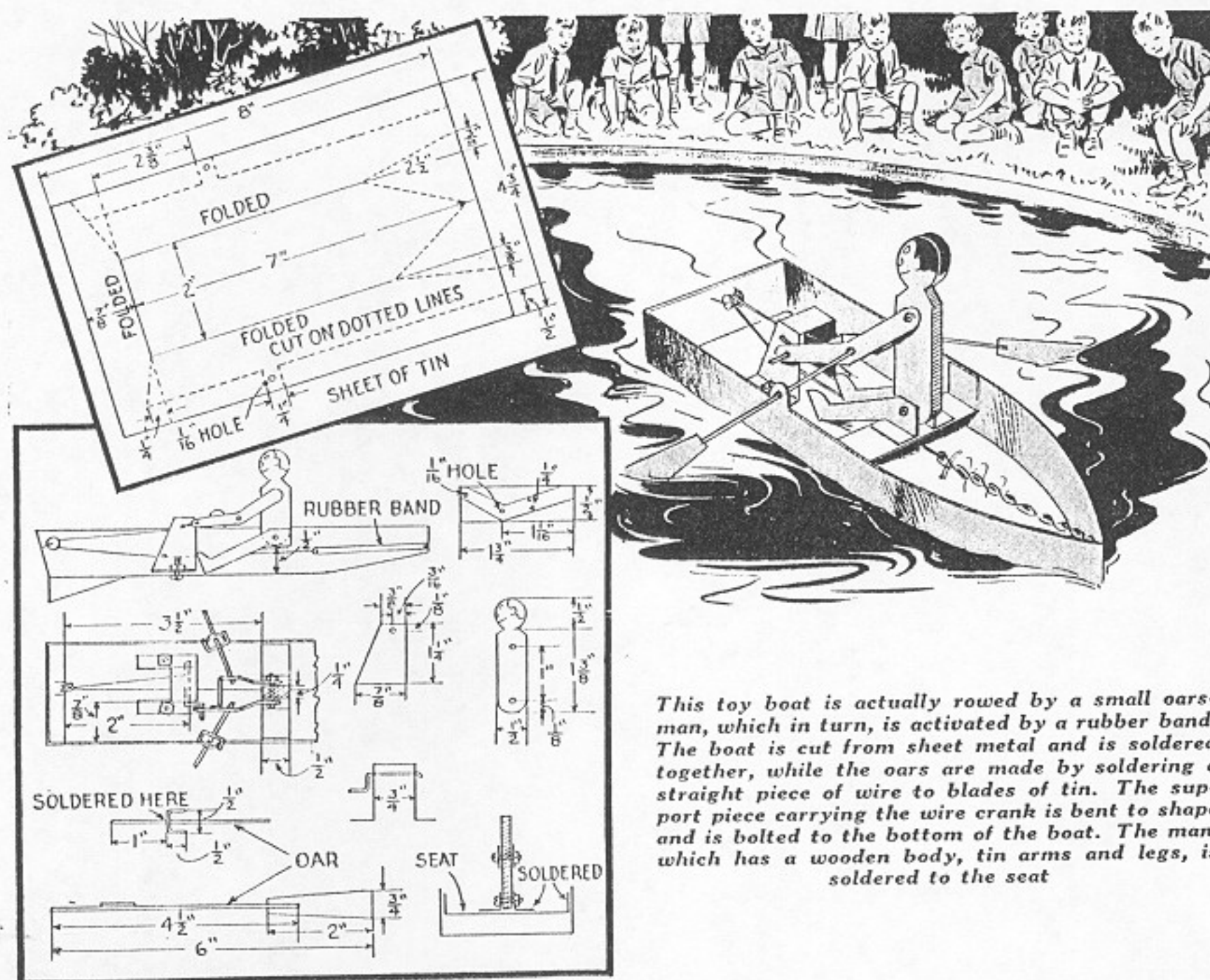
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March 1937

POPULAR MECHANICS

Midget Oarsman Works This Toy Rowboat



This toy boat is actually rowed by a small oarsman, which in turn, is activated by a rubber band. The boat is cut from sheet metal and is soldered together, while the oars are made by soldering a straight piece of wire to blades of tin. The support piece carrying the wire crank is bent to shape and is bolted to the bottom of the boat. The man, which has a wooden body, tin arms and legs, is soldered to the seat.

KNOTS, SPLICES and ROPE WORK

A PRACTICAL TREATISE

Giving Complete and Simple Directions for Making All the Most Useful and Ornamental Knots in Common Use, with Chapters on Splicing, Pointing, Seizing, Serving, etc. Adapted for the use of Travellers, Campers, Yachtsmen, Boy Scouts, and all others having to use or handle ropes for any purpose.

By

A. HYATT VERRILL

Editor Popular Science Dept., "American Boy Magazine."



SECOND REVISED EDITION

Illustrated with 156 Original Cuts Showing How Each Knot, Tie or Splice is Formed and Its Appearance When Complete.

NEW YORK
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1917

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INTRODUCTION

THE history of ropes and knots is so dim and ancient that really little is known of their origin. That earliest man used cordage of some kind and by his ingenuity succeeded in tying the material together, is indisputable, for the most ancient carvings and decorations of prehistoric man show knots in several forms. Doubtless the trailing vines and plants first suggested ropes to human beings; and it is quite probable that these same vines, in their various twistings and twinings, gave man

his first idea of knots.

Since the earliest times knots have been everywhere interwoven with human affairs; jugglers have used them in their tricks; they have become almost a part of many occupations and trades, while in song and story they have become the symbol of steadfastness and strength.

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Few realize the importance that knots and cordage have played in the world's history, but if it had not been for these simple and every-day things, which as a rule are given far too little consideration, the human race could never have developed beyond savages. Indeed, I am not sure but it would be safe to state that the real difference between civilized and savage man consists largely in the knowledge of knots and rope work. No cloth could be woven, no net or seine knitted, no bow strung and no craft sailed on lake or sea without numerous knots and proper lines or ropes; and Columbus himself would have been far more handicapped without knots than without a compass.

History abounds with mention of knots, and in the eighth book of "Odyssey" Ulysses is represented as securing various articles of raiment by a rope fastened in a "knot closed with Circean art"; and as further proof of the prominence the ancients gave to knots the famous Gordian Knot may be mentioned. Probably no one will ever learn just how this fabulous knot was tied, and like many modern knots it was

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doubtless far easier for Alexander to cut it than to untie it.

The old sorcerers used knots in various ways, and the witches of Lapland sold sailors so-called "Wind Knots," which were untied by the sailors when they desired a particular wind. Even modern conjurors and wizards use knots extensively in their exhibitions and upon the accuracy and manner in which their knots are tied depends the success of their tricks.

In heraldry many knots have been used as symbols and badges and many old Coats of Arms bear intricate and handsome knots, or entwined ropes, emblazoned upon them.

As to the utility of knots and rope work there can be no question. A little knowledge of knots has saved many a life in storm and wreck, and if every one knew how to quickly and securely tie a knot there would be far fewer casualties in hotel and similar fires. In a thousand ways and times a knowledge of rope and knots is useful and many times necessary. Many an accident has occurred through a knot or splice being improperly formed, and even in tying an ordinary bundle or "roping" a trunk or

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box few people tie a knot that is secure and yet readily undone and quickly made. In a life of travel and adventure in out-of-the-way places, in yachting or boating, in hunting or fishing, and even in motoring, to command a number of good knots and splices is to make life safer, easier, and more enjoyable, aside from the real pleasure one may find in learning the interesting art of knot-tying.

Through countless ages the various forms of knots and fastenings for rope, cable, or cord have been developed; the best kinds being steadily improved and handed down from generation to generation, while the poor or inferior fastenings have been discarded by those whose callings required the use of cordage.

Gradually, too, each profession or trade has adopted the knots best suited to its requirements, and thus we find the Sailor's Knot; the Weaver's Knot; Fishermen's knots; Builders' knots; Butchers' knots; and many others which have taken their names from the use to which they are especially adapted.

In addition to these useful knots, there

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are many kinds of ornamental or fancy knots used in ornamenting the ends of ropes, decorating shrouds of vessels, railings,

and similar objects; while certain braids or plaits, formed by a series of knots, are widely used aboard ship and on land.

In many cases ropes or cable must be joined in such a way that they present a smooth and even surface and for such purposes splices are used, while knots used merely as temporary fastenings and which must be readily and quickly tied and untied are commonly known as "bends" or "hitches." Oddly enough, it is far easier to tie a poor knot than a good one, and in ninety-nine cases out of a hundred the tyro, when attempting to join two ropes together, will tie either a "slippery" or a "jamming" knot and will seldom succeed in making a recognized and "ship-shape" knot of any sort.

The number of knots, ties, bends, hitches, splices, and shortenings in use is almost unlimited and they are most confusing and bewildering to the uninitiated. The most useful and ornamental, as well as the most reliable, are comparatively few in number,

and in reality each knot learned leads readily to another; in the following pages I have endeavored to describe them in such a manner that their construction may be readily understood and mastered.

THE AUTHOR.

JANUARY, 1917.

KNOTS, SPLICES AND ROPE WORK

CHAPTER I

CORDAGE

Before taking up the matter of knots and splices in detail it may be well to give attention to cordage in general. Cordage, in its broadest sense, includes all forms and kinds of rope, string, twine, cable, etc., formed of braided or twisted strands. In making a rope or line the fibres (A, Fig. 1)

of hemp, jute, cotton, or other material are loosely twisted together to form what is technically known as a "yarn" (B, Fig. 1). When two or more yarns are twisted together they form a "strand" (C, Fig. 1). Three or more strands form a rope (D, Fig. 1), and three ropes form a cable (E, Fig. 1). To form a strand the yarns are twisted together in the opposite direction from that in which the original fibres were twisted; to form a rope the strands are twisted in the opposite direction from the

yarns of the strands, and to form a cable each rope is twisted opposite from the twist of the strands. In this way the natural tendency for each yarn, strand, or rope to untwist serves to bind or hold the whole firmly together (Fig. 1).

Rope is usually three-stranded and the

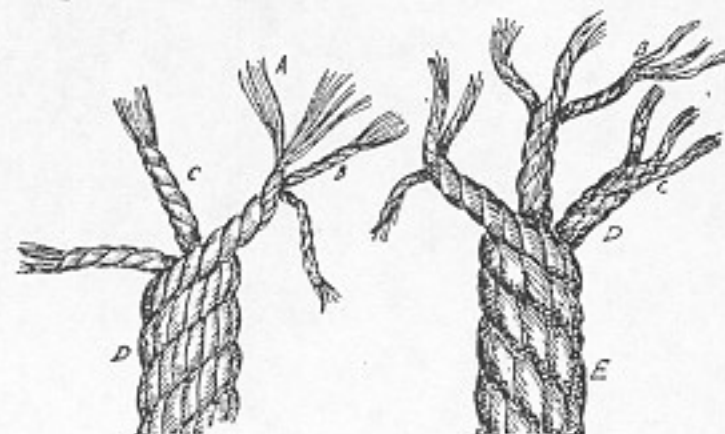


FIG. 1.—Construction of rope.

strands turn from left to right or "with the sun," while cable is left-handed or twisted "against the sun" (E, Fig. 1). Certain ropes, such as "bolt-rope" and most cables, are laid around a "core" (F, Fig. 2) or central strand and in many cases are four-stranded (Fig. 2).

The strength of a rope depends largely upon the strength and length of the fibres from which it is made, but the amount each

yarn and strand is twisted, as well as the method used in bleaching or preparing the fibres, has much to do with the strength of the finished line.

Roughly, the strength of ropes may be calculated by multiplying the circumference of the rope in inches by itself and the fifth



FIG. 2.—Bolt-rope.

part of the product will be the number of tons the rope will sustain. For example, if the rope is 5 inches in circumference, $5 \times 5 = 25$, one-fifth of which is 5, the number of tons that can safely be carried on a 5-inch rope. To ascertain the weight of ordinary "right hand" rope, multiply the circumference in inches by itself and multiply the result by the length of rope in fathoms and divide the product by 3.75.

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For example, to find the weight of a 5-inch rope, 50 fathoms in length: $5 \times 5 = 25$; $25 \times 50 = 1,250$; $1,250 \div 3.75 = 333\frac{1}{3}$ lbs. These figures apply to Manila or hemp rope, which is the kind commonly used, but jute, sisal-flax, grass, and silk are also used considerably. Cotton rope is seldom used save for small hand-lines, clothes-lines, twine, etc., while wire rope is largely used nowadays for rigging vessels, derricks, winches, etc., but as splicing wire rope is different from the method employed in fibre rope, and as knots have no place in wire rigging, we will not consider it.

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CHAPTER II

SIMPLE KNOTS AND BENDS

For convenience in handling rope and learning the various knots, ties, and bends, we use the terms "standing part," "bight," and "end" (Fig. 3). The *Standing Part* is the principal portion or longest part of the rope; the *Bight* is the part curved or bent while working or handling; while the *End* is that part used in forming the knot or hitch. Before commencing work the loose ends or strands of a rope should be "whipped"

or "seized" to prevent the rope from unravelling; and although an expert can readily tie almost any knot, make a splice, or in fact do pretty nearly anything with a loose-ended rope, yet it is a wise plan to invariably whip the end of every rope, cable, or hawser to be handled, while a marline-spike, fid, or pointed stick will also prove of great help in working rope.

To whip or seize a rope-end, take a piece of twine or string and lay it on the rope an

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inch or two from the end, pass the twine several times around the rope, keeping the ends of the twine under the first few



FIG. 3.—Parts of rope.

turns to hold it in place; then make a large loop with the free end of twine; bring it back to the rope and continue winding

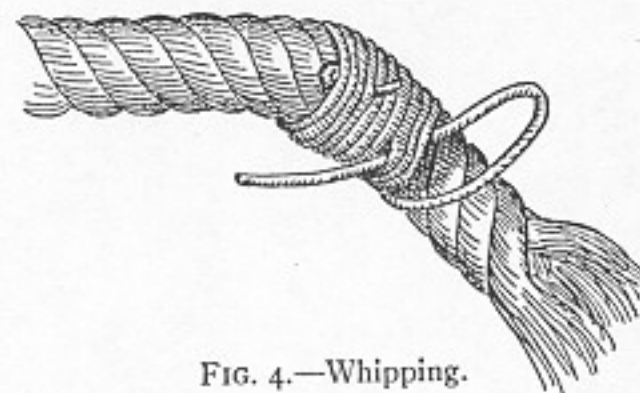


FIG. 4.—Whipping.

for three or four turns around both rope and end of twine; and then finish by drawing the loop tight by pulling on the free end (Fig. 4).

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All knots are begun by "loops" or rings commonly known to mariners as "Cuckolds' Necks" (Fig. 5). These may be either overhand or underhand, and when a seizing or fastening of twine is placed around the two parts where they cross a useful rope ring known as a "clinch" is formed (Fig. 6). If the loose end of the rope is passed over

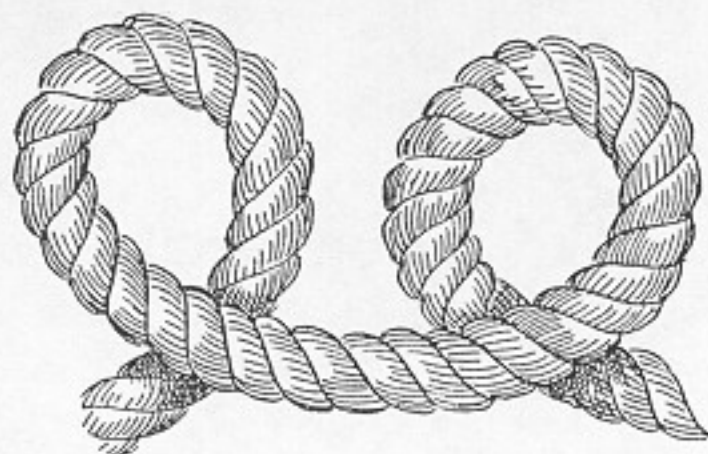


FIG. 5.—Cuckolds' necks.



FIG. 6.—Clinch.

the standing part and through the "cuck-
old's neck," the simplest of all knots, known
as the "Overhand Knot," is made (Fig. 7).
This drawn tight appears as in Fig. 8, and
while so simple this knot is important, as it



FIG. 7

FIG. 8

FIGS. 7 and 8.—Overhand knots.

is frequently used in fastening the ends of
yarns and strands in splicing, whipping, and
seizing. The "Figure-Eight Knot" is al-
most as simple as the overhand and is
plainly shown in Figs. 9 and 10. Only a

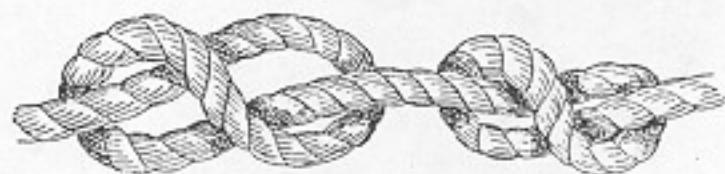


FIG. 9

FIG. 10

FIGS. 9 and 10.—Figure-eight knots.

step beyond the figure-eight and the over-
hand knots are the "Square" and "Reefing"
knots (Figs. 11 and 12). The square knot
is probably the most useful and widely used
of any common knot and is the best all-

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around knot known. It is very strong,

never slips or becomes jammed, and is
readily untied. To make a square knot,
take the ends of the rope and pass the left

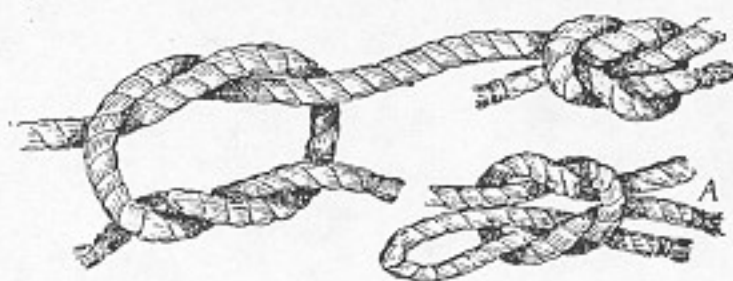


FIG. 11



FIG. 12

FIGS. 11 and 12.—Square knots.

end over and under the right end, then the
right over and under the left. If you once
learn the simple formula of "Left over,"
"Right over," you will never make a mis-



FIG. 13.—Granny knot.

take and form the despised "Granny," a
most useless, bothersome, and deceptive
makeshift for any purpose (Fig. 13). The
true "Reef Knot" is merely the square knot

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with the bight of the left or right end used
instead of the end itself. This enables the
knot to be "cast off" more readily than the
regular square knot (A, Fig. 12). Neither
square nor reef knots, however, are reliable



FIG. 14.—Slipped square knot.

when tying two ropes of unequal size to-
gether, for under such conditions they will
frequently slip and appear as in Fig. 14, and
sooner or later will pull apart. To prevent
this the ends may be tied or seized as



FIG. 15.—Square knot with ends seized.

shown in Fig. 15. A better way to join two ropes of unequal diameter is to use the "Open-hand Knot." This knot is shown in Fig. 16, and is very quickly and easily made; it never slips or gives, but is rather

²³ large and clumsy, and if too great a strain is put on the rope it is more likely to break at the knot than at any other spot. The "Fisherman's Knot," shown in Fig. 17, is a good knot and is formed by two simple overhand knots slipped over each rope,

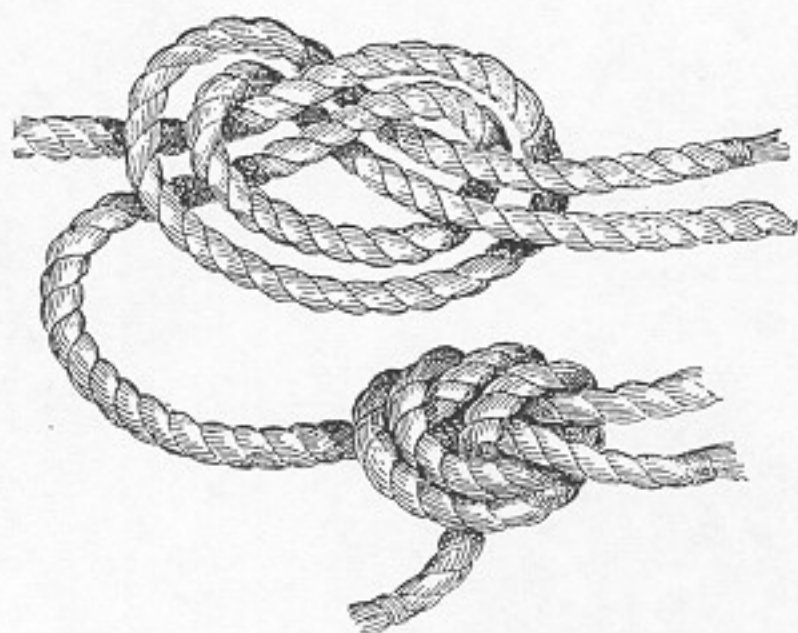


FIG. 16.—Open-hand knots.

and when drawn taut appears as in Fig. 18. This is an important and valuable knot for anglers, as the two lines may be drawn apart by taking hold of the ends, *A*, *B*, and a third line for a sinker, or extra hook, may be inserted between them. In joining gut lines the knot should be left

²⁴ slightly open and the space between wrapped with silk. This is probably the strongest known method of fastening fine lines.

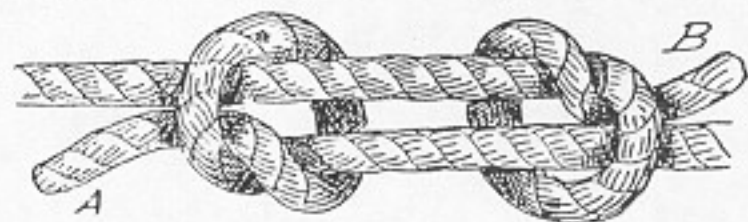


FIG. 17.—Fisherman's knot (making).



FIG. 18.—Fisherman's knot (finished).

The "Ordinary Knot," for fastening heavy ropes, is shown in Fig. 19. It is made by forming a simple knot and then



FIG. 19.—Ordinary knot (finished).

interlacing the other rope or "following around," as shown in Fig. 20. This knot is very strong, will not slip, is easy to make,

²⁵ and does not strain the fibres of the rope. Moreover, ropes joined with this knot will pay out, or hang, in a straight line. By whipping the ends to the standing parts it

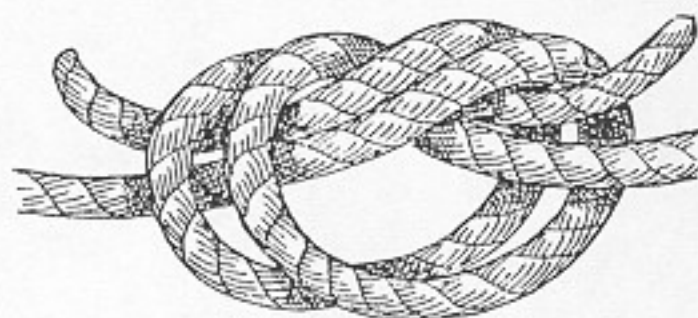


FIG. 20.—Ordinary knot (tying).

becomes a neat and handsome knot (Fig. 21). The "Weaver's Knot" (Fig. 22) is more useful in joining small lines, or twine, than for rope, and for thread it is without



FIG. 21.—Ordinary knot (seized).

doubt the best knot known. The ends are crossed as in Fig. 23. The end *A* is then looped back over the end *B*, and the end *B* is slipped through loop *C* and drawn tight.

Another useful and handsome knot is illustrated in Fig. 24. This is a variation ²⁶

of the figure-eight knot, already described, and is used where there is too much rope,



FIG. 22.—Weaver's knot (complete).

or where a simple knot is desired to prevent the rope running through an eye, ring, or

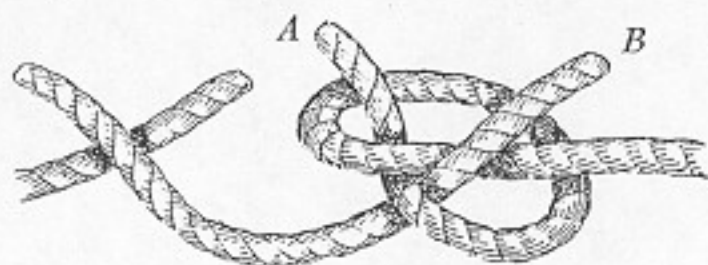


FIG. 23.—Weaver's knot (tying).

tackle-block. It is made by forming a regular figure eight and then "following



FIG. 24.—Double figure-eight knot (complete).

round" with the other rope as in Fig. 25. It is then drawn taut and the ends seized to the standing part if desired.

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Sometimes we have occasion to join two heavy or stiff ropes or hawsers, and for this purpose the "Garrick Bend" (Fig. 26) is

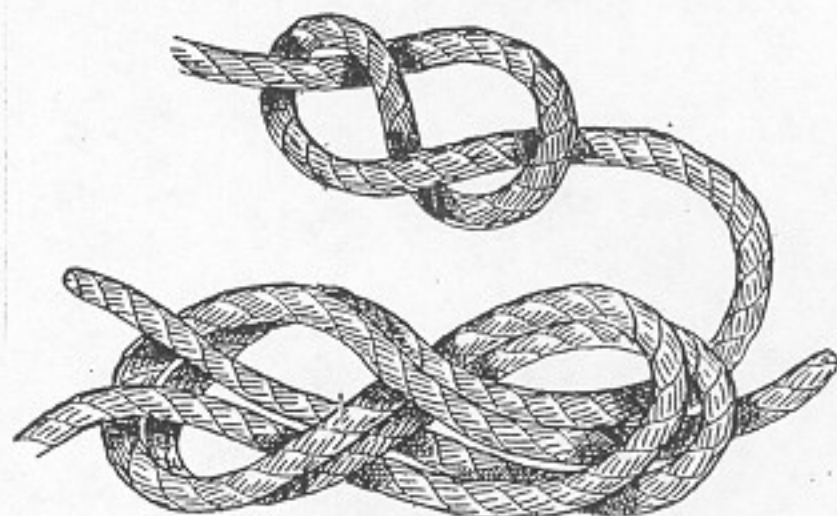


FIG. 25.—Double figure-eight knot (tying).

preeminently the best of all knots. To make this knot, form a bight by laying



FIG. 26.—Garrick bend (finished).

the end of a rope on top of and across the standing part. Next take the end of the other rope and pass it through this bight,

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first down, then up, over the cross and down through the bight again, so that it comes out on the opposite side from the other end, thus bringing one end on top and the other



FIG. 27.—Garrick bend (tying).

below, as illustrated in Fig. 27. If the lines are very stiff or heavy the knot may be secured by seizing the ends to the standing



FIG. 28.—Simple hitch (hawser).

parts. A much simpler and a far poorer knot is sometimes used in fastening two heavy ropes together. This is a simple hitch within a loop, as illustrated in Fig.

29

28, but while it has the advantage of being quickly and easily tied it is so inferior to the Garrick bend that I advise all to adopt the latter in its place.

When two heavy lines are to be fastened for any considerable time, a good method



FIG. 29.—Half-hitch and seizing.

is to use the "Half-hitch and Seizing," shown in Fig. 29. This is a secure and easy method of fastening ropes together and it allows the rope to be handled more easily, and to pass around a winch or to be coiled much more readily, than when other knots are used.

CHAPTER III

TIES AND HITCHES

All the knots I have so far described are used mainly for fastening the two ends of a rope, or of two ropes, together. Of quite a different class are the knots used in making a rope fast to a stationary or solid object, and are known as "hitches" or "ties."

One of the easiest of this class to make and one which is very useful in fastening a boat or other object where it may be necessary to release it quickly is the "Lark's Head" (Fig. 30). To make this tie, pass a bight of your rope through the ring, or other object, to which you are making fast and then pass a marline-spike, a billet of wood, or any similar object through the sides of the bight and under or behind the standing part, as shown in *A*, Fig. 30. The end of the rope may then be laid over and under the standing part and back over itself. This knot may be instantly released

³¹by merely pulling out the toggle. Almost as quickly made and unfastened is the "Slippery Hitch" (Fig. 32). To make this, run the end of the rope through the ring or eye to which it is being fastened, then back over the standing part and pull a loop,

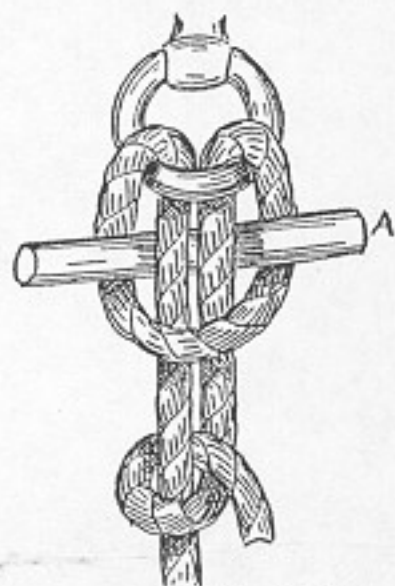


FIG. 30.—Lark's head with toggle (*A*).



FIG. 31.—Lark's head with toggle (*A*) withdrawn.

or bight, back through the "cuckold's neck" thus formed (Fig. 33). To untie, merely

pull on the free end. Two half-hitches, either around a post or timber or around the standing part of the rope, make an ideal and quickly tied fastening (Figs. 34 and 35). To make these, pass the end around

³²the post, ring, or other object, then over and around the standing part between the post and itself, then under and around the

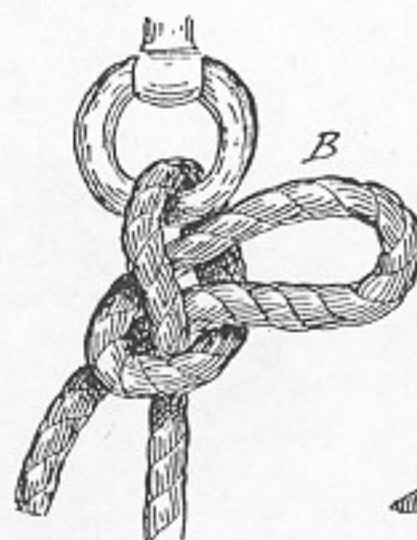


FIG. 32.—Slippery hitch (complete).

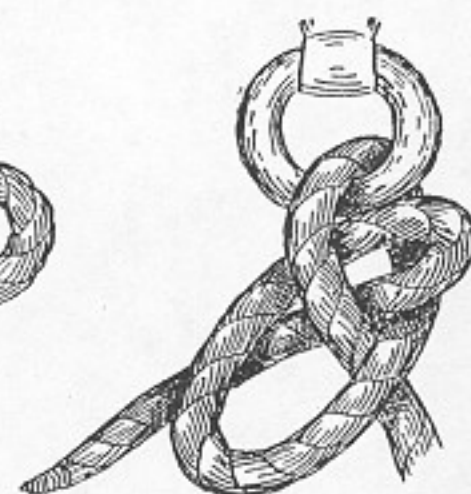


FIG. 33.—Slippery hitch (tying).

standing part and between its own loop and the first one formed. After a little practice you can tie this knot almost instantly and by merely throwing a couple of turns around a post, two half-hitches may be formed instantly. This knot will hold forever without loosening, and even on a smooth, round stick or spar it will stand an enormous strain without slipping. A more secure knot for this same purpose is the "Clove Hitch" (Fig. 36), sometimes

³³known as the "Builders' Hitch." To make this, pass the end of rope around the spar or timber, then over itself; over and around the spar, and pass the end under itself and between rope and spar, as shown in the illustration. The Clove hitch with ends knotted becomes the "Gunners' Knot"



Fig. 34.



Fig. 35.

FIGS. 34 and 35.—Half-hitches.

(Fig. 37). These are among the most valuable and important of knots and are useful in a thousand and one places. The Clove hitch will hold fast on a smooth timber and is used extensively by builders for fastening the staging to the upright posts. It is also useful in making a tow-line fast to a wet spar, or timber, and even on a slimy and slippery spile it will seldom slip. For this purpose the "Timber Hitch" (Fig. 32) is even better than the Clove hitch. It is

³⁴
easily made by passing the end of a rope around the spar or log, round the standing part of the rope and then twist it three or more times around, under and over itself.



FIG. 36 A.—Clove hitch or builder's hitch (tying).

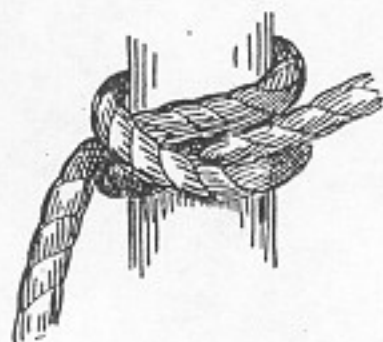


FIG. 36 B.—Clove hitch (complete).

If you wish this still more secure, a single half-hitch may be taken with the line a couple of feet further along the spar (Fig. 39).

³⁵

It is remarkable what power to grip a twisted rope has, and the "Twist Knots" shown in Figs. 40 and 41 illustrate two ways of making fast which are really not knots at all but merely twists. These may be finished by a simple knot, or a bow-knot, as shown in Fig. 42, but they are likely to jam under great pressure and are mainly

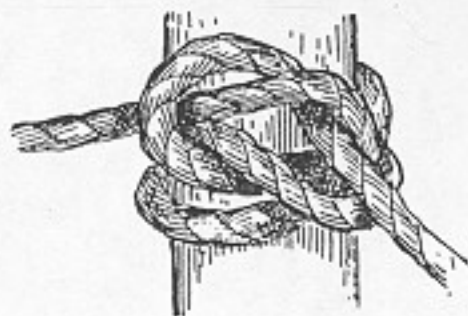


FIG. 37.—Gunner's knot.

useful in tying packages, or bundles, with

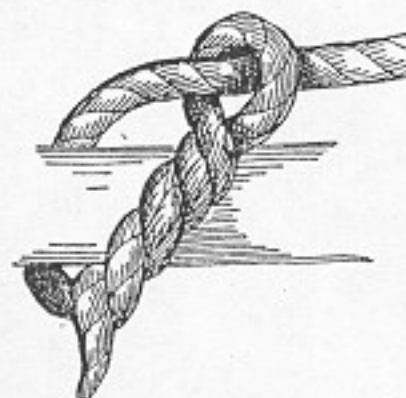


FIG. 38.—Timber hitch.

³⁶

small cord, where the line must be held taut until the knot is completed. This principle of fastening by twisted rope is also utilized

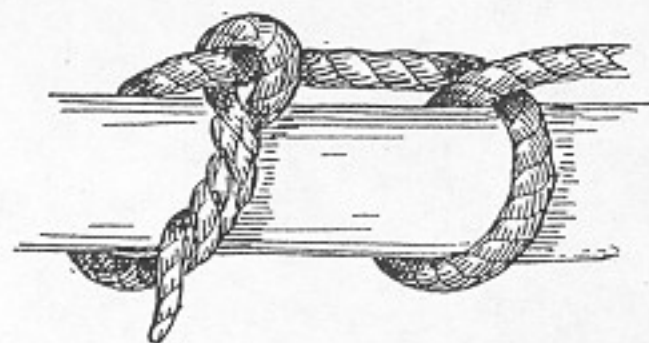
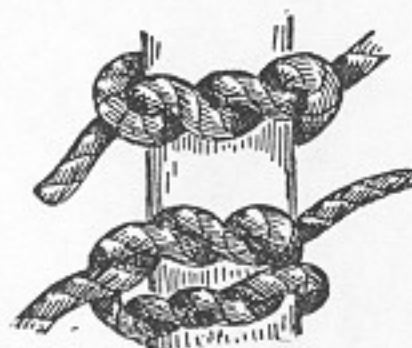


FIG. 39.—Timber hitch and half-hitch.

in the "Catspaw" (Fig. 43), a most useful knot or "hitch" for hoisting with a hook.



FIGS. 40 and 41.—"Twists."

To make this, pass the bight of your rope over the end and standing part, then, with a bight in each hand, take three twists from

³⁷

you, then bring the two bights side by side

and throw over the hook (Fig. 44).

The "Blackwall Hitch" (Fig. 45) is still



FIG. 42.—Twist with bow.

simpler and easier to make and merely consists of a loop, or cuckold's neck, with the end of rope passed underneath the standing

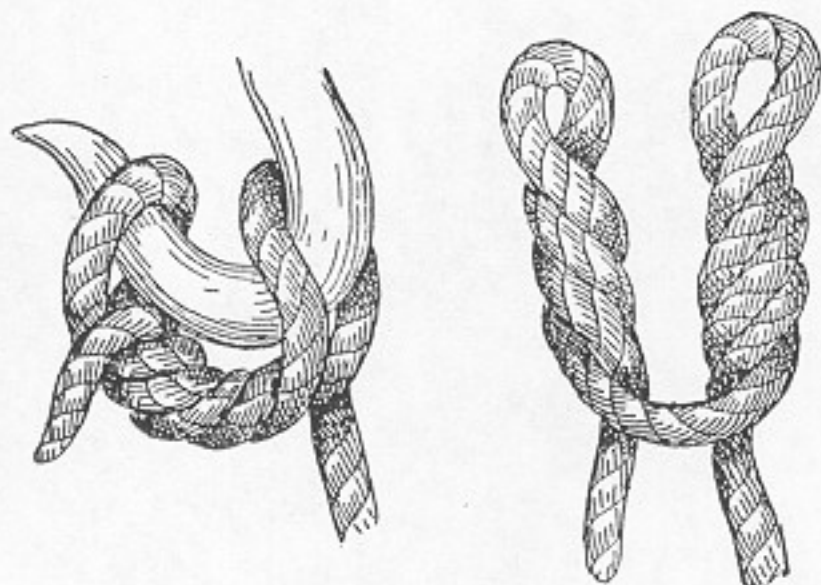


FIG. 43.—Catspaw.



FIG. 44.—Catspaw (tying).

part and across the hook so that as soon as pressure is exerted the standing part bears on the end and jams it against the hook.



FIG. 45.—Blackwall hitch.

The "Chain Hitch" (Fig. 46) is a very strong method of fastening a line to a timber, or large rope, where one has a rope of sufficient length, and is used frequently to help haul in a large rope or for similar purposes. It consists simply of a number of half-hitches taken at intervals around the object and is sometimes used with a



FIG. 46.—Chain hitch.

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lever or handspike, as shown in Fig. 47. The "Rolling Hitch" is a modified Clove hitch and is shown in Fig. 48. The

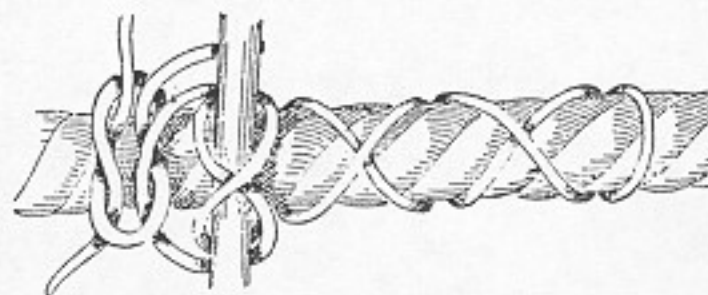


FIG. 47.—Chain hitch with bar.

"Magnus Hitch" (Fig. 49) is a method frequently used on shipboard for holding spars; and the "Studding-sail Bend" (Fig. 50) is also used for this purpose. Occasions



FIG. 48.—Rolling hitch.



FIG. 49.—Magnus hitch.

sometimes arise where a tackle, hook, ring, or another rope must be fastened to a beam by the same rope being used, and in such

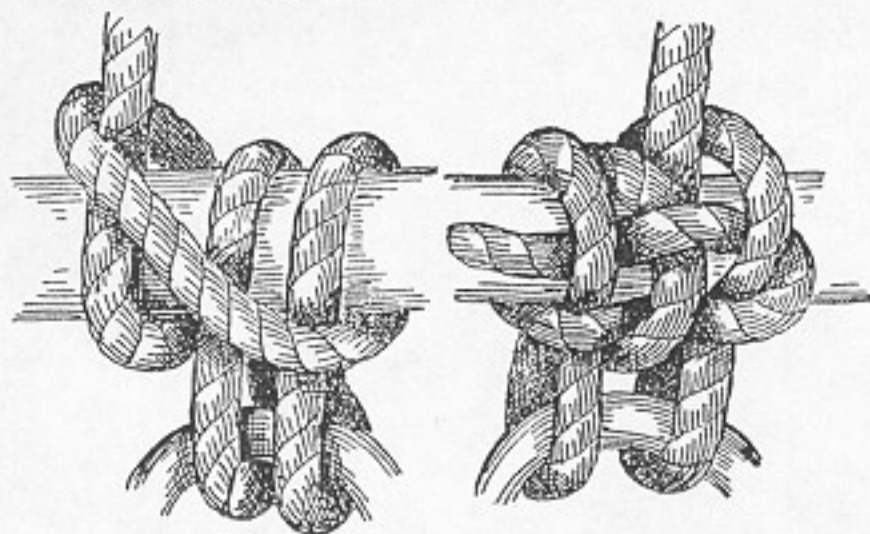
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cases the "Roband Hitch" (Fig. 51) comes in very handy. These are all so simple and easily understood from the figures that no



FIG. 50.—Studding-sail bend.

explanation is necessary. Almost as simple are the "Midshipman's Hitch" (Fig. 52), the "Fisherman's Hitch" (Fig. 53), and the

FIG. 51 A.—Roband hitch
(front).FIG. 51 B.—Roband hitch
(back).

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"Gaff Topsail Halyard Bend" (Fig. 54). The midshipman's hitch is made by taking a half-hitch around the standing part and a round turn twice around above it. The



FIG. 52.—Midshipman's hitch.

fisherman's hitch is particularly useful in making fast large hawsers; with the end of a rope take two turns around a spar, or through a ring; take a half-hitch around

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FIG. 53.—Fisherman's hitch.

the standing part and under all the turns; then a half-hitch round the standing part only and if desired seize the end to standing part. The gaff-topsail bend is formed by passing two turns around the yard and

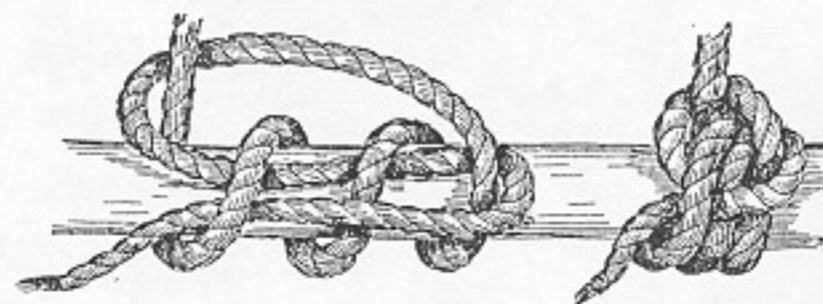


FIG. 54.—Gaff-topsail halyard bend.

coming up on a third turn over both the first two turns; over its own part and one turn; then stick the end under the first turn.

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CHAPTER IV

NOOSES, LOOPS AND MOORING KNOTS

Nothing is more interesting to a landsman than the manner in which a sailor handles huge, dripping hawsers or cables and with a few deft turns makes then fast to a pier-head or spile, in such a way that the ship's winches, warping the huge structure on or from the dock, do not cause the slightest give or slip to the rope and yet, a moment later, with a few quick motions, the line is cast off, tightened up anew, or paid out as required. Clove hitches, used as illustrated in Fig. 55, and known as the "Waterman's Knot," are often used, with a man holding the free end, for in this way a slight pull holds the knot fast, while a little slack gives the knot a chance to slip without giving way entirely and without exerting any appreciable pull on the man holding the end.

"Larks' Heads" are also used in conjunction with a running noose, as shown in Fig.

44



FIG. 55.—Waterman's knot.

56, while a few turns under and over and around a cleat, or about two spiles, is a method easily understood and universally used by sailors (Fig. 57). The sailor's knot

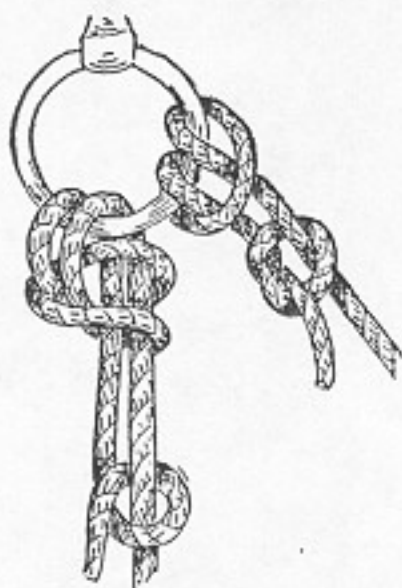


FIG. 56.—Larks' heads and running noose.

par excellence, however, is the "Bow-line" (Fig. 58), and wherever we find sailors, or

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seamen, we will find this knot in one or another of its various forms. When you can readily and surely tie this knot every time, you may feel yourself on the road to "Marline-spike Seamanship," for it is a true

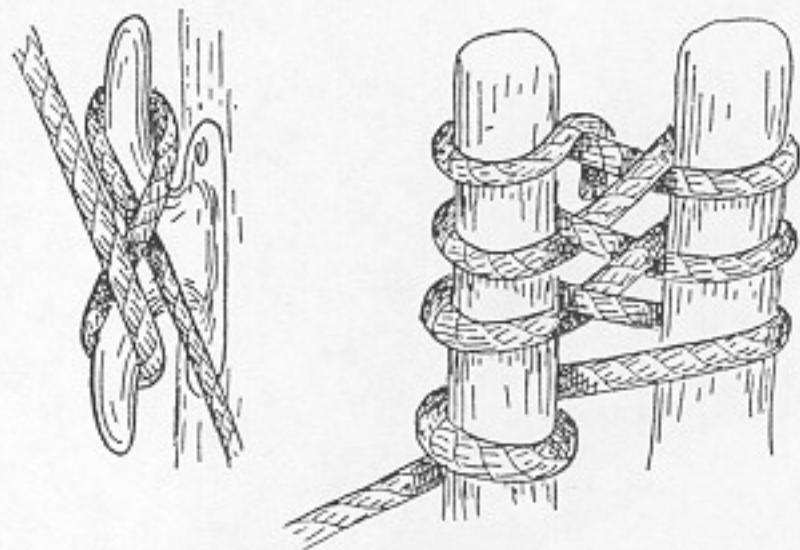


FIG. 57.—Cleat and wharf ties.

sailor's knot and never slips, jams, or fails; is easily and quickly untied, and is useful in a hundred places around boats or in fact in any walk of life. The knot in its various stages is well shown in Fig. 59 and by following these illustrations you will understand it much better than by a description alone. In *A* the rope is shown with a bight or cuckold's neck formed with the end over

46
the standing part. Pass *A* back through the bight, under, then over, then under, as shown in *B*, then over and down through the bight, as shown in *C* and *D*, and draw

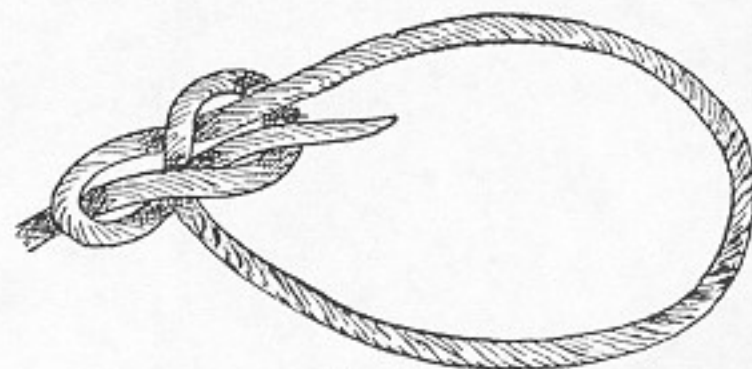


FIG. 58.—Bow-line.

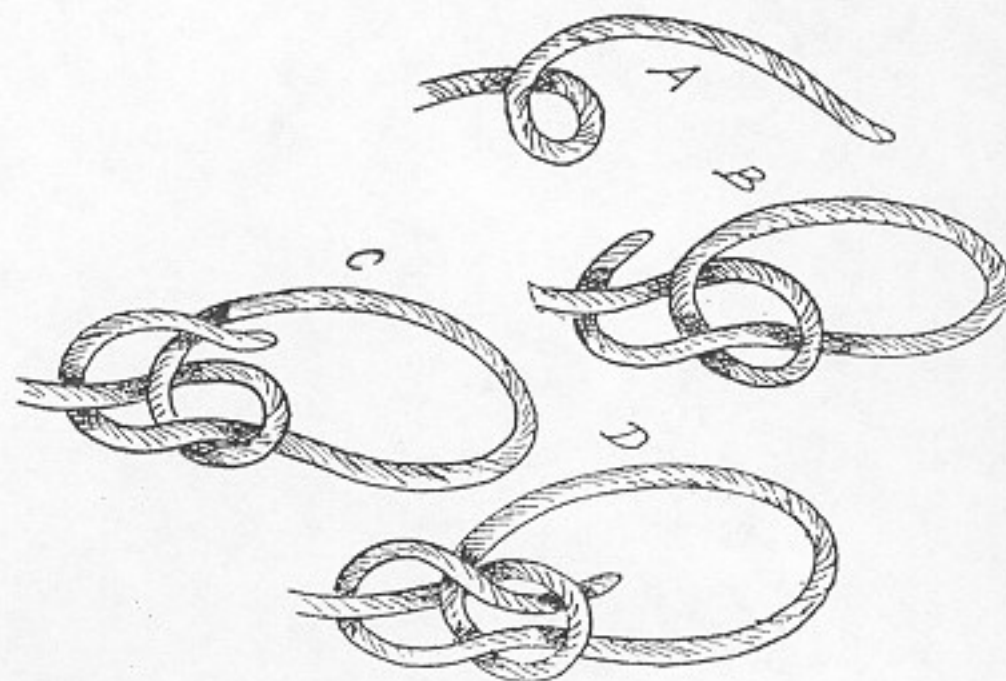


FIG. 59.—Tying bow-line.

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taut, as in *E*. The "Bow-line on a Bight" (Fig. 60) is just as easily made and is very useful in slinging casks or barrels and in forming a seat for men to be lowered over cliffs, or buildings, or to be hoisted aloft

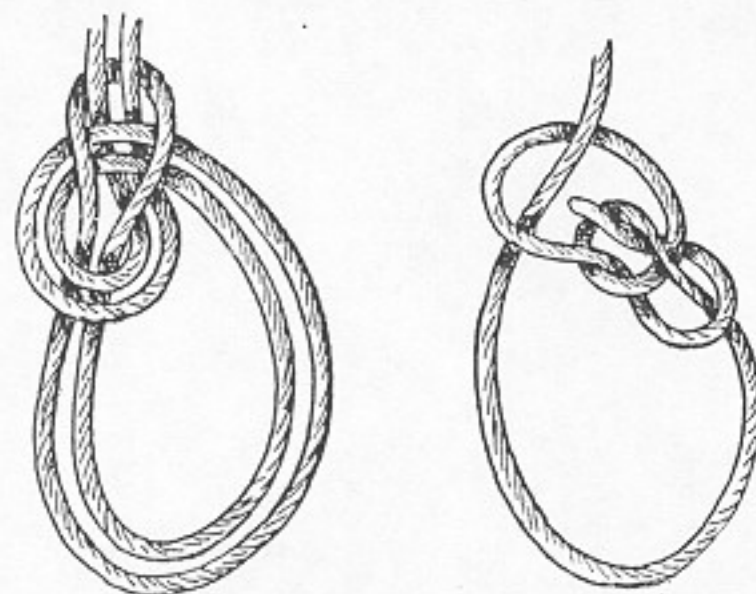


FIG. 60.—Bow-line on bight.

FIG. 61.—Running bow-line.

aboard ship for painting, cleaning, or rigging. A "Running Bow-line" (Fig. 61) is merely a bow-line with the end passed through the loop, thus forming a slip knot. Other "Loops" are made as shown in Figs. 62-65, but none of these are as safe, sure, and useful as the bow-line. One of these knots, known as the "Tomfool Knot" (Fig. 66), is used as

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handcuffs and has become quite famous, owing to its having baffled a number of "Handcuff Kings" and other performers



FIG. 62.—Loop knot.



FIG. 63.—Loop knot.



FIG. 64.—Loop knot.



FIG. 65.—Loop knot.

who readily escaped from common knots and manacles. It is made like the running knot (Fig. 62), and the firm end is then passed

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through the open, simple knot so as to form a double loop or bow. If the hands or wrists are placed within these loops and

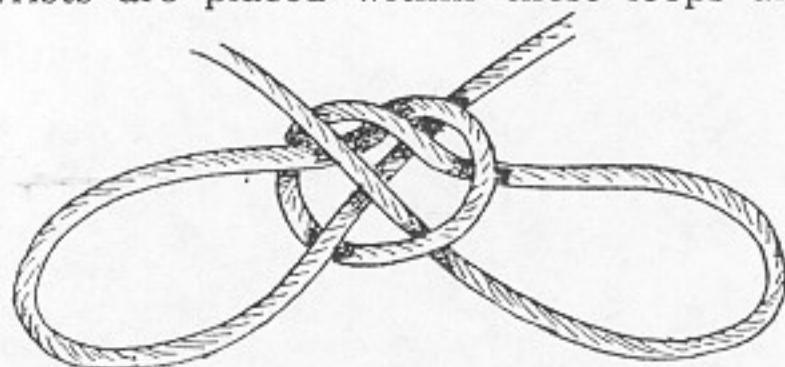


FIG. 66.—Tomfool knot.

the latter drawn taut, and the loose ends tied firmly around the central part, a pair of wonderfully secure handcuffs results.

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CHAPTER V

SHORTENINGS, GROMMETS, AND SELVAGEES

In many cases a rope may prove too long for our use or the free ends may be awkward, or in the way. At such times a knowledge of "shortenings" is valuable. There are quite a variety of these useful knots, nearly all of which are rather handsome and ornamental, in fact a number of them are in constant use aboard ship merely for ornament.

The simplest form of shortening, shown in Fig. 67, is a variation of the common and simple overhand knot already described and illustrated. These knots are formed by passing the end of a rope twice or more times through the loop of the simple knot and then drawing it tight (Fig. 68). They are known as "Double," "Treble," "Four-fold," or "Sixfold" knots and are used to prevent a rope from passing through a ring or block as well as for shortening. All gradations from the double to the sixfold

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are shown in Fig. 69, both in process of making and as they appear when drawn taut. Another very simple form of shortening is shown in Fig. 70 and is known as



FIG. 67.—Twofold shortening (making).

FIG. 68.—Twofold shortening (taut).

the "Single Plait," or "Chain Knot." To make this shortening, make a running loop (A, Fig. 70), then draw a bight of the rope through this loop, as shown at B, draw another bight through this, as at C to D, and continue in this way until the rope is shortened to the desired length; the free



FIG. 69.—Three- and fivefold shortening.

end should then be fastened by passing a bit of stick through the last loop, *F*, or by

running the free end through the last loop, as at *E*. To undo this shortening, it is only necessary to slip out the free end, or the bit of wood, and pull on the end, when

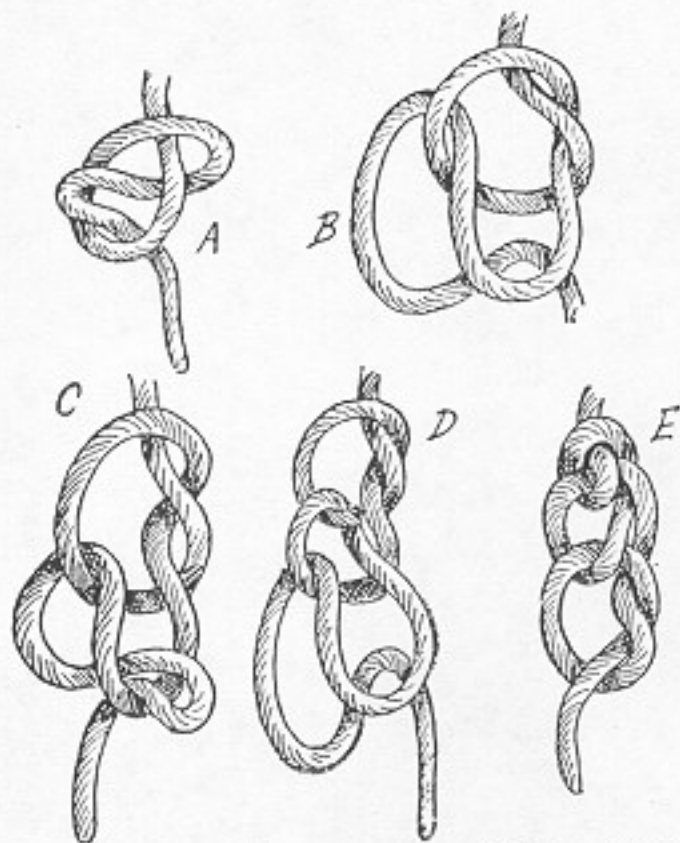


FIG. 70.—Single plait or monkey chain (making).

the entire knot will quickly unravel. The "Twist," or "Double Chain," is made in a similar manner but is commenced in a different way (*A*, Fig. 71). It may also be made with three separate pieces of line, as

shown in *B*, Fig. 71.⁵³ Hold the double loop in the left hand; the part *A* is then brought over *B*; with a half turn *B* is crossed over to *A*, and then proceed as in the ordinary three-strand plait until the end of loop is reached, when the loose end is fastened by passing through the bight and the completed shortening appears as in Fig. 72. This same process is often used by Mexicans and Westerners in making bridles, headstalls, etc., of leather. The leather to be used is slit lengthwise from near one end to near



FIG. 70 F.—Monkey chain or single plait (complete).

the other, as shown in Fig. 73, and the braid is formed as described.⁵⁴

as in Fig. 74, and in this way the ends of the leather strap remain uncut, and thus much stronger and neater than they would be were three separate strips used.

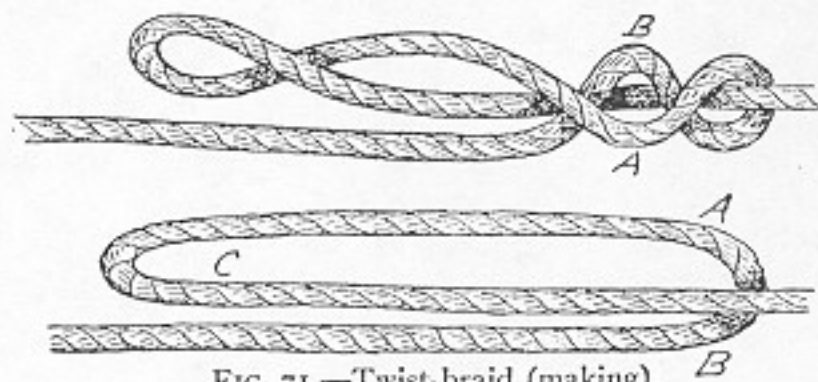


FIG. 71.—Twist braid (making).



FIG. 72.—Twist braid (complete).

Another handsome knot for shortening is the more highly ornamental "Open Chain" (Fig. 75). Make the first loop of the rope

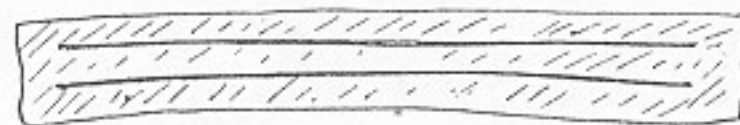


FIG. 73.—Leather cut to braid.

secure by a twist of the rope and then pass the loose end through the preceding loop, to right and left alternately, until the knot is complete.



FIG. 74.—Leather braid (complete).

The simplest of all shortenings consists

of a loop taken in the rope with the bights seized to the standing part (Fig. 76). This is particularly well adapted to heavy rope

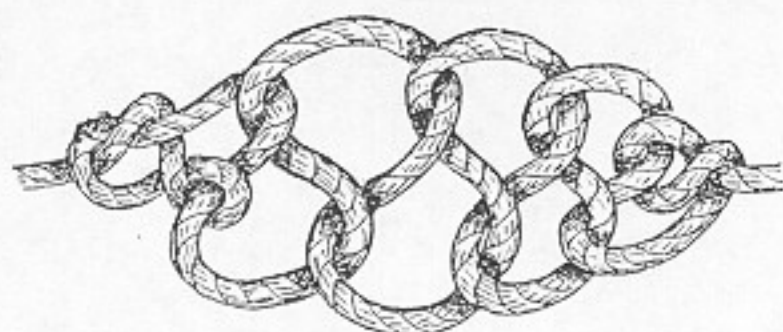


FIG. 75.—Open chain.

or where a shortening must be made quickly. Fig. 77 shows another very simple shorten-



FIG. 76.—Seized shortening.

ing, which requires no description. This will not withstand a very great strain but is

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secure from untying by accident and is very useful for taking up spare rope or lashings on bundles or baggage. "Sheepshanks,"

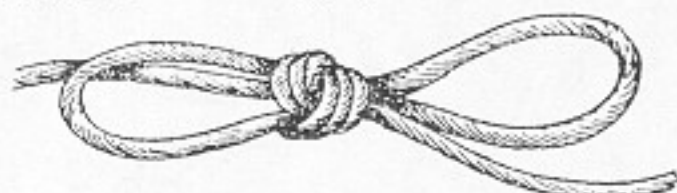


FIG. 77.—Bow shortening.

or "Dogshanks," are widely used for shortening rope, especially where both ends are fast, as they can be readily made in the

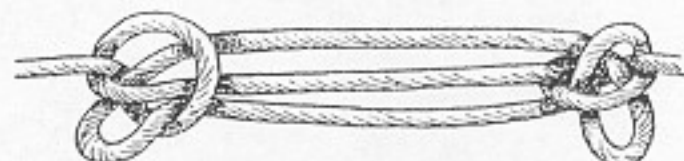


FIG. 78.—Sheepshank.

centre of a tied rope. There are several forms of these useful knots. The best and most secure form is shown in Fig. 78. A

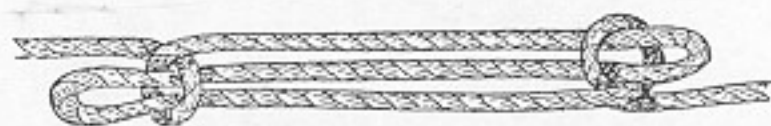


FIG. 79.—Another sheepshank.

simple running knot is first made; a bend

is pushed through the loop, which is then drawn taut; the other end of the bend is fastened in a similar manner and the shortening is complete. A much simpler form is shown in Fig. 79, but this can hardly be depended upon unless the ends are seized,

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FIG. 80.—Sheepshank with ends seized.

as shown in Fig. 80. Figs. 81-82 illustrate two other forms of shortenings, but these can only be used where the end of the rope

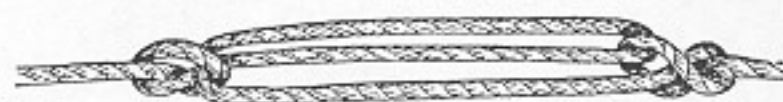


FIG. 81.—Sheepshank for free-ended rope.

is free, and are intended for more permanent fastenings than the ordinary sheepshank; while Fig. 83 is particularly adapted to be



FIG. 82.—Sheepshank for free-ended rope.

cast loose at a moment's notice by jerking out the toggles, A, B.

Grommets are round, endless rings of rope useful in a myriad ways aboard ship

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as well as ashore. They are often used as handles for chests, for rings with which to play quoits, to lengthen rope, and in many similar ways. The grommet is formed of a single strand of rope *five times as long as the circumference of the grommet when*

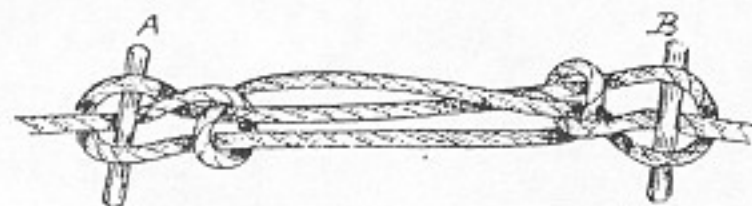


FIG. 83.—Sheepshank with toggle.

complete. Take the strand and lay one end across the other at the size of loop required and with the long end follow the grooves or "lay" of the strand until back to where you started (Fig. 84), thus

forming a two-stranded ring. Then continue twisting the free end between the turns already made until the three-strand ring is complete (Fig. 85). Now finish and secure the ends by making overhand knots, pass the ends underneath the nearest strands and trim ends off close (Fig. 86). If care is taken and you remember to keep a strong twist on the strand while "laying up" the grommet, the finished ring will be as

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firm and smooth and endless as the original rope.

A "Sevagee" or "Selvagee" strap is another kind of ring (Fig. 87). This is made by passing a number of strands or yarns

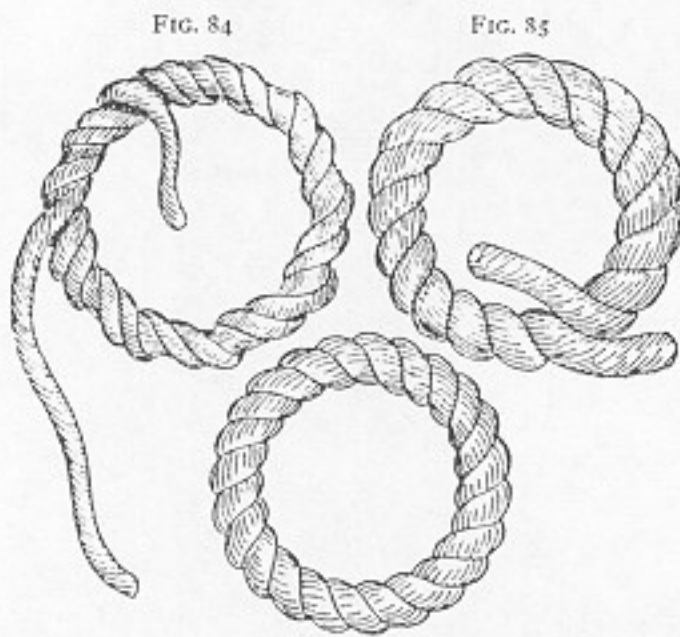


FIG. 86

FIGS. 84, 85, and 86.—Grommet complete and making.

around pins or nails set in a board (Fig. 88), and binding the whole together with a seizing of yarn or marline (Fig. 89). These are strong, durable straps much used for blocks aboard ship, for handles to boxes and chests, and in many similar ways. A "Flemish Eye" (Fig. 90) is an eye made in a manner

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much like that employed in forming the selvagee strap. Take a spar or piece of



FIG. 87.—Selvagee strap.

wood the size of the intended eye *A*. Around this wood lay a number of pieces of yarn or marline, *B, B, B*, and fasten them by tying with twine as at *C*. Whip the

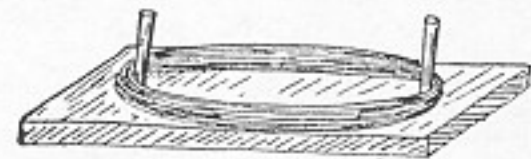


FIG. 88.—Selvagee board.

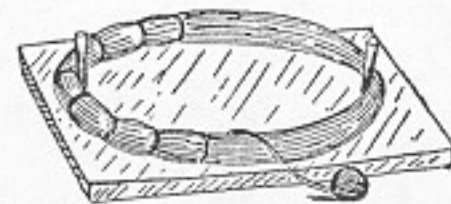


FIG. 89.—Seizing a selvagee strap.

piece of rope in which eye is to be formed and unravel and open out the strands as at *D*. Lap the yarns over the wood and

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the stops *B*, and fasten together by overhand knots *E*, worm the free ends under and over and then bring up the ends of the stops *B* and tie around the strands of eye as shown. The eye may be finished neatly by

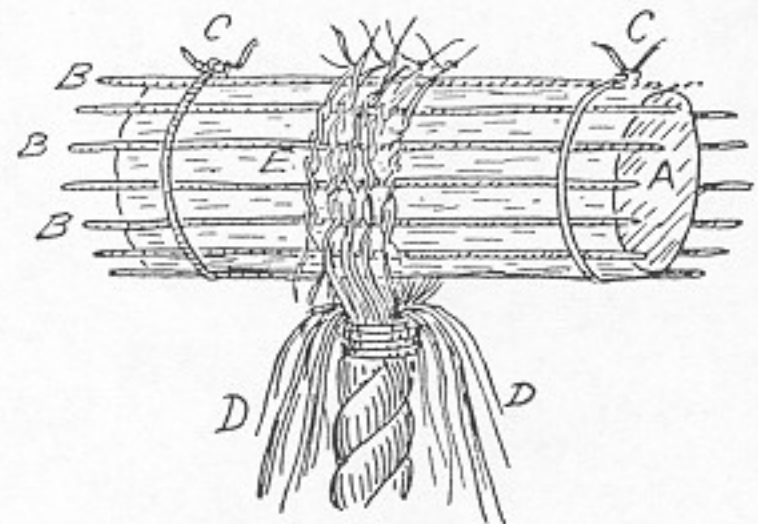


FIG. 90 A.—Making Flemish eye.

whipping all around with yarn or marline, and will then appear as in Fig. 90 *B*. An "Artificial Eye" (Fig. 91) is still another form of eye which will be found useful and in some ways easier and quicker to make than a spliced eye, besides being stronger.

Take the end of a rope and unlay one strand; place the two remaining strands back alongside of the standing part (Fig. 92).

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Pass the loose strand which has been unlaid

over the end, and follow around the spaces between the two strands and then around eye,—as in making a grommet,—until it



FIG. 90 B.—Flemish eye
(complete).



FIG. 91.—Artificial eye.

returns down the standing part and lies under the eye with the strands (Fig. 93). Then divide the strands, taper them down, and whip the whole with yarn or marline (Fig. 94).

Still another eye which at times will be useful is the "Throat Seizing," shown in Fig. 95. This is made by opening the end slightly and lashing it to the standing part

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FIG. 92

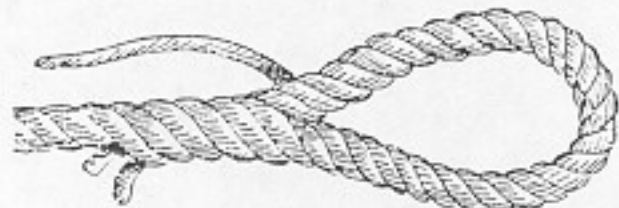


FIG. 93

FIGS. 92 and 93.—Making artificial eye.

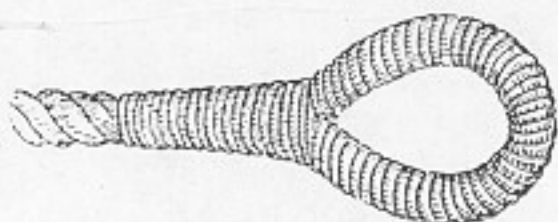


FIG. 94.—Artificial eye (whipped).



FIG. 95.—Throat seizing.

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as shown. Another ring sometimes used is illustrated in Fig. 96, and is easily and quickly made by lashing the two ends of a



FIG. 96.—Lashed cut-splice.

short rope to the standing part of another. Cuckolds' necks with lashings or "Clinches" are also used for the same purpose.

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CHAPTER VI

LASHINGS, SEIZINGS, SPLICES, ETC.

Almost any one can lash a rope more or less satisfactorily, but a knowledge of how to do this properly and in the manner best suited to each case is of great importance to seamen and others having occasion to handle ropes, rigging, or in fact any cordage.

The varieties of lashings, seizings, whippings, and servings are almost innumerable, but a few of the best and most frequently used are the "Wedding Knot" or "Rose Lashing," the "Deadeye Lashing," the "Belaying-pin Splice," the "Necklace Tie," the "Close Band," and "End Pointings." The rose lashing (Fig. 97) is used to join two eyes or ropes finished with loops. The deadeye lashing (Fig. 98) is frequently used on ships' standing rigging and is a familiar sight to every one who has seen a sailing-vessel. It consists of a small line reeved back and forth through the holes in the "deadeyes," A; the ends are then seized

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to the standing rigging to prevent slipping. This lashing admits of easy and rapid lengthening or shortening of the rig-

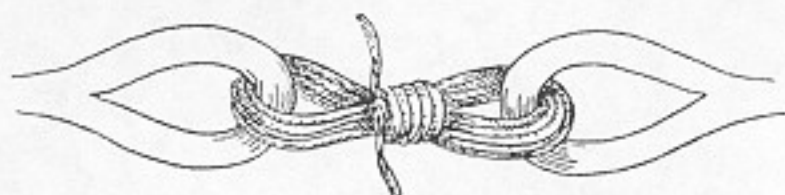


FIG. 97.—Rose lashing.

ging and is particularly useful in connection with wire cable. A similar method may be used with loops instead of deadeyes (Fig.

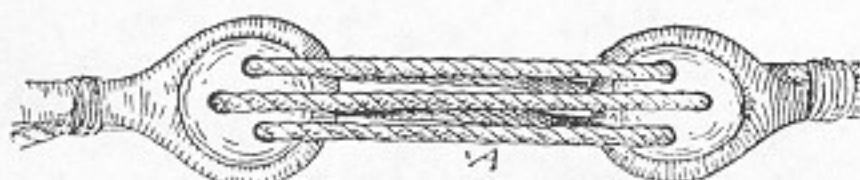


FIG. 98.—Deadeye lashing.

99). The belaying-pin splice, shown in Fig. 100, is a quick and handy way of fastening two ropes together and is of great value



FIG. 99.—Loop lashing.

when rigging is carried away and some quick method of joining the severed ends is required. Pass a belaying-pin or similar

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toggle through an eye or loop in one end of a rope and pass this through a loop or eye in the broken rope end. Form a loop in the other broken end, slip the free end of

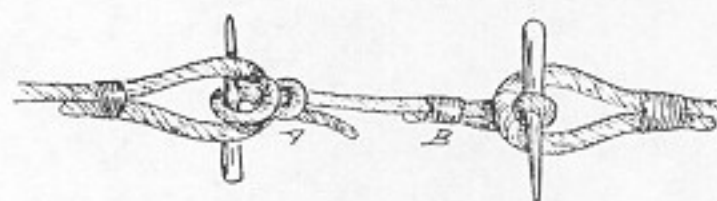


FIG. 100.—Belaying-pin splice.

the lanyard through this and around another toggle or pin and haul taut; then fasten by half-hitches around standing part (A, Fig. 100), or by seizing (B, Fig. 100). This is a strong, reliable fastening and can be tightened up or instantly thrown off at will.

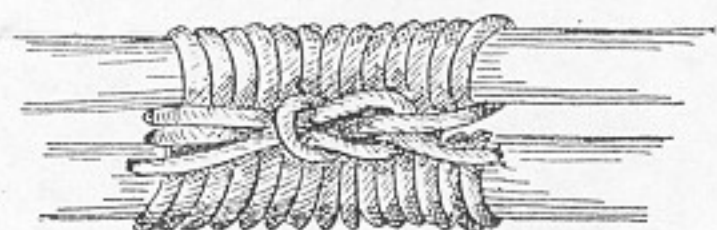


FIG. 101.—Necklace tie.

The necklace tie is useful in holding two ropes, hawsers, or timbers side by side (Fig. 101). The lashing is passed around and around the two objects to be joined and the

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ends secured by a square knot passed around the band lengthwise. The close band is used for the same purposes as the last and is made in the same manner, but the ends are fastened by drawing through beneath the turns (Fig. 102).

End pointings are very useful as well as ornamental, for while an ordinary seizing or whipping will prevent the strands from

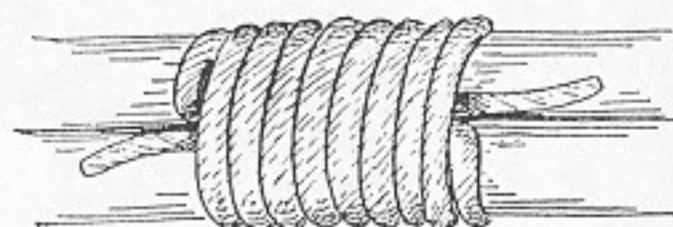


FIG. 102.—Close band.

unravelling, the ends are broad and clumsy and oftentimes are too large to pass through a block or eye large enough for the rest of the rope. The ordinary way of pointing a rope is to first whip as described (Fig. 4), and then unlay the end as for the Flemish eye. Take out about two-thirds of the yarns and twist each in two. Take two parts of different yarns and twist together with finger and thumb, keeping the lay on the yarn and thus forming left-handed stuff

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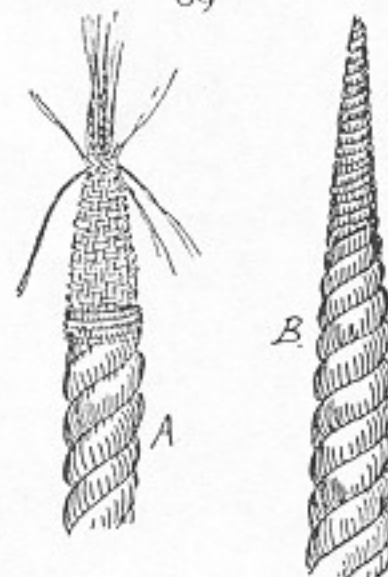


FIG. 103.—Pointing a rope.

known as "nettles." Comb out the rest of the yarn with a knife, leaving a few to

lay back upon the rope. Now pass three turns of twine like a timber-hitch tightly around the part where the nettles separate and fasten the twine, and while passing this "warp" lay the nettles backward and forward with each turn. The ends are now whipped with twine or yarn and finally "snaked," which is done by taking the end under and over the outer turns of the seizing alternately. If the rope is small a stick is often put in the upper part to

strengthen it or the tip may be finished with a small eye. If properly done a pointed rope is very handsome and appears as in *B*, Fig. 103. Another simple way of finish-



FIG. 104.—Ending rope.

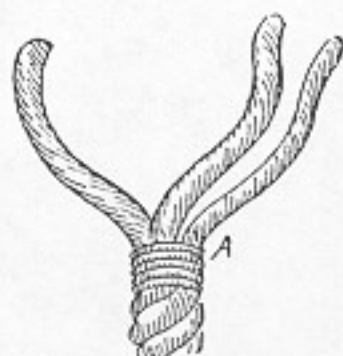


FIG. 105.—Ending rope.

ing a rope end is to seize the end, as at *A*, Fig. 104, and open out the strands, bring the strands back alongside the rope, and whip the whole (Fig. 105).

Splicing is, in many cases, more useful and better than tying or bending ropes together and a good splice always looks neater and more ship-shape than a knot, no matter how well-made it may be. A person familiar with splicing will turn in a splice almost as quickly as the ordinary man can tie a secure knot, and in many cases, where the rope must pass through sheaves or

blocks, a splice is absolutely necessary to fasten two ropes or two parts of a parted rope together. The simplest of all splices is known as the "Short Splice" (Fig. 106). This is made as follows: Untwist the ends of the rope for a few inches and seize with twine to prevent further unwinding, as shown at *A*, *A*; also seize the end of each

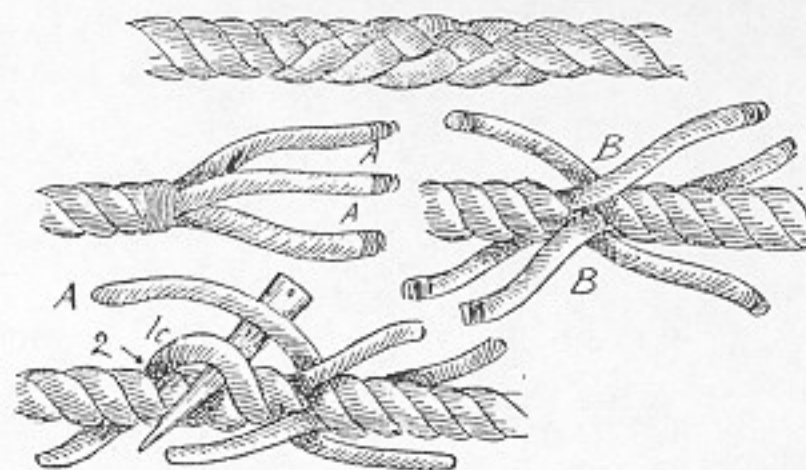


FIG. 106.—Short splice.



FIG. 106 D.—Short splice (continued).

strand to prevent unravelling and grease

or wax the strands until smooth and even. Now place the two ends of the ropes together as shown at *B*, *B*. Then with a marline-spike, or a pointed stick, work open the strand 1 *c*, and through this pass the strand *A* of the other rope; then open strand 2 and pass the next strand of the other rope through it and then the same way with the third strand. Next open up the strands of the other rope, below the seizing, and pass the strands of the first rope through as before, 3 *A*, *B*. The ropes will now appear as in Fig. 106, *D*. Now untwist the six strands and cut away about half the yarns from each and seize the ends as before; pass these reduced strands through under the whole strands of the rope—the strands of the left under the strands of the right rope and *vice versa*—for two or three lays and then cut off projecting ends, after drawing all as tight as you can. If an extra-neat splice is desired the strands should be gradually tapered as you proceed, and in this way a splice but little larger than the original diameter of the rope will result. The only difficulty you will find in making this splice is in getting the strands to come

together in such a way that two strands

will not run under the same strand of the opposite rope. To avoid this, bear in mind that the *first strand must be passed over the strand which is first next to it and through under the second and out between the second and third*. In the following operations the strands are passed *over* the third and *under*

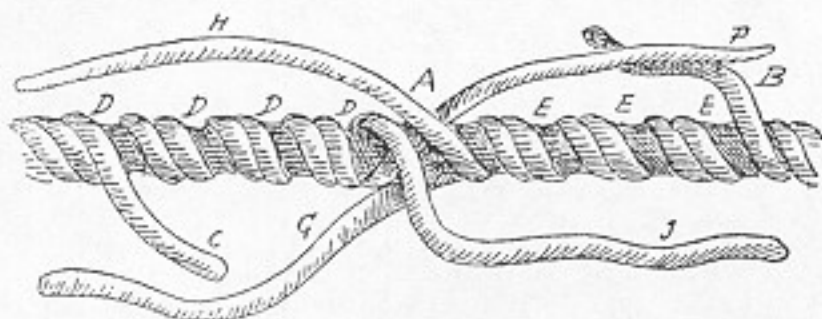


FIG. 107.—Long splice.

the fourth; but the figures will make this perfectly clear. A far better and stronger splice is the "Long Splice," which will run through any block or tackle which will admit the rope itself; indeed, a well-made long splice cannot be distinguished from the rope itself after a few days' use (Fig. 107). To make this useful splice, unlay the ends of the rope about four times as much as for the short splice, or from four to five feet, unlay one strand in each rope for half as

much again; place the middle strands together as at *A*, then the additional strands will appear as at *B* and *C*, and the spiral groove, left where they were unlaid, will appear as at *D* and *E*. Take off the two central strands, *F* and *G*, and lay them into



FIG. 108.—Eye splice.

the grooves, *D*, *E*, until they meet *B* and *C*, and be sure and keep them tightly twisted while so doing. Then take strands *H* and *J*,

cut out half the yarns in each, make an overhand knot in them and tuck the ends under the next lays as in a short splice. Do the same with strands *B*, *C* and *F*, *G*; dividing, knotting, and sticking the divided strands in the same way. Finally stretch the rope

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tight, pull and pound and roll the splice until smooth and round, and trim off all loose ends close to the rope.

An "Eye Splice" (Fig. 108) is very easy to make and is useful and handy in a great variety of ways. It is made in the same manner as the short splice, but instead of splicing the two ends together, the end of



FIG. 109.—Cut splice.

the rope is unlaid and then bent around and spliced into its own strands of the standing part, as shown in the illustration. A "Cut Splice" (Fig. 109) is made just as an eye splice or short splice, but instead of splicing two ropes together end to end, or splicing an end into a standing part, the ends are lapped and each is spliced into the standing part of the other, thus forming a loop or eye in the centre of a rope. Once the short

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and long splices are mastered, all other splices, as well as many useful variations, will come easy. Oftentimes, for example, one strand of a rope may become worn, frayed, or broken, while the remaining strands are perfectly sound. In such cases the weak strand may be unlaid and cut off and then a new strand of the same length is laid up in the groove left by the old strand exactly as in a long splice; the ends are then tapered, stuck under the lay, as in a short splice, and the repair is complete; and if well done will never show and will be as strong as the original rope.

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CHAPTER VII

FANCY KNOTS AND ROPE WORK

The knots and splices described above are all more for practical use than ornament, although such shortenings as the Single and Double plaits, the Chain knots, the Twofold, Fourfold, and Sixfold knots, and others are often used for ornamental purposes only. A certain class of knots are, however, really ornamental and seldom serve to fasten two ropes together, or to make any object fast to another. They are, however, very useful in many ways, especially aboard ship, and they are so handsome and interesting that every one interested in rope work should learn to make them. The simplest of the fancy knots is known as the "Single Crown" (Fig. 110). To form this knot unlay the strands of a new, flexible rope for six to eight inches and whip the ends of each strand, as well as the standing part, to prevent further untwisting. Hold the rope in your left hand and fold one strand over

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and away from you, as shown in *A*, Fig. 111. Then fold the next strand over *A* (see *B*, Fig. 111), and then, while holding these in place with thumb and finger, pass the strand *C* over strand *B*, and through the bight of *A* as shown in the illustration. Now pull



FIG. 110.—Single crown. FIG. 111.—Single crown (making).

all ends tight and work the bights up smooth and snug; cut off ends and the knot is complete. This single crown is a very poor knot to stand by itself, however, and is mainly valuable as a basis for other more complicated knots and for ending up rope.

To end up a rope with a crown it is merely necessary to leave the projecting ends long and then by bringing them down tuck under the strands of the standing part, as shown in Fig. 112. Then halve the strands and tuck

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again, as in making a short splice, until the result appears as in Fig. 113. This makes a neat, handy, and ship-shape finish to a



FIG. 112.—Single crown tucked (making).



FIG. 113.—Single crown tucked (complete).

rope's end and is very useful for painters, halyards, etc. It will never work loose like a seizing and is quickly put on at any time,



FIG. 114.—Wall knot.

whereas to make a seizing one must be provided with small stuff of some sort, and this is frequently not at hand. The "Wall Knot" (Fig. 114) is almost as simple as the crown, and in fact is practically a

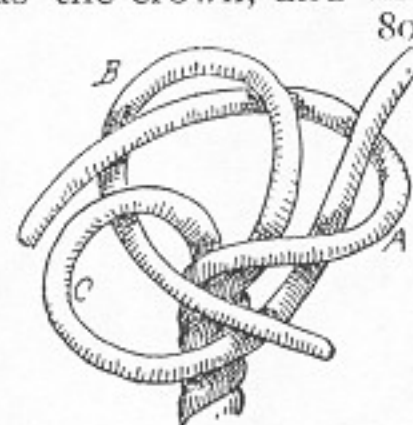


FIG. 115.—Wall knot (making).



FIG. 116.—Wall knot (tucked).

crown reversed. In making this knot bring *C* downward and across the standing part; then bring *A* over *C* and around standing part and finally bring *B* over *A* and up

through bight of *C*, Fig. 115. When drawn snug the ends may be trimmed off close or they may be tucked and tapered as in the crown and will then appear as in Fig. 116. As in the case of the crown knot, the wall is mainly of value as an ending when ends are tucked, or as a basis for more ornamental knots such as the "Wall and Crown," or "Double Wall," or "Double Crown." It is also very largely used in making "Shroud Knots" (Fig. 117). The common shroud knot is made by opening up the

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strands of a rope's end as for a short splice and placing the two ends together in the same way. Then single "wall" the strands of one rope around the standing part of another against the lay, taper the ends, and



FIG. 117.—Shroud knot (complete).



FIG. 118.—Shroud knot (making).

tuck and serve all with yarn or marline (Fig. 118). The "French Shroud Knot" is far neater and better, but is a little harder to make. Open up the strands and place closely together as for the short splice; make a loop of strand *A*, pass the end of *B* through the bight of *A*, as at *C*, make a loop of strand *D*, and pass the end of strand *A* through it as at *D*; then pass the end of

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strand *D* through the bight of strand *B* and one side is complete. Repeat the operation on the other side, draw all ends taut, and taper and tuck the ends. The whole should then be served carefully and the finished knot will appear as in Fig. 120.

Double wall and double crown as well

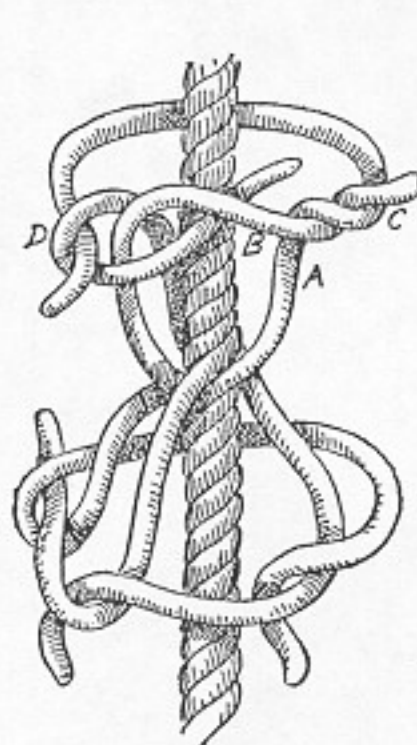


FIG. 119.—French shroud knot (making).



FIG. 120.—French shroud knot (complete).

as the beautiful double wall-and-crown knots are made exactly like the single

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crown or wall but instead of trimming off or tucking the ends they are carried around a second time following the lay of



FIG. 121 A.—Making double crown.



FIG. 121 B.—Making double wall.

the first, as shown in Fig. 121, which shows the construction of a double crown at *A*,



FIG. 122.—Double crown (complete).



FIG. 123.—Double wall (complete).

and a double wall at *B*. When finished, the ends may be tucked or trimmed and the two knots will look like Figs. 122 and 123.

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A far better effect is obtained by "Crowning" a wall knot. This is done by first making a single wall knot and then by bringing strand *A* up over the top and laying *B* across *A* and bringing *C* over *B* and through the bight of *A*; a crown knot is formed above the wall, as shown in Figs. 124 and 125. This is the foundation of the



FIG. 124.—Wall crowned (making).



FIG. 125.—Wall crowned (complete).

most beautiful of rope-end knots, known as the "Double Wall and Crown," or "Man-rope Knot," illustrated in Fig. 126. Make your single wall and crown it, but leave the strands all slack; then pass the ends up and through the bights of the slack single-wall knot and then push them alongside the strands in the single crown; push-

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ing them through the same bight in the crown and downward through the walling. This may seem quite difficult, but if you have learned the wall and crown you will find it simple enough, for it is really merely "following" the strands of the single wall and crown. The result, if properly done,



FIG. 126.—Double wall and crown.



FIG. 127.—Double wall and crown (complete).

and ends drawn tight and cut off closely, is surprising, and to the uninitiated most

perplexing, for if the ends are tapered and tucked through the standing part of the ropes, as shown in Fig. 127, there will be no sign of a beginning or ending to this knot. This is probably the most useful of decorative knots and is largely used aboard ship for finishing the ends of rope railings, the ends of man-ropes, for the ends of yoke-

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lines and to form "stoppers" or "toggles" to bucket handles, slings, etc. Its use in this way is illustrated in Figs. 128-130, which show how to make a handy topsail-halyard toggle from an eye splice turned in a short piece of rope and finished with a double wall and crown at the end. These toggles are very useful about small boats, as they may be used as stops for furling



FIG. 128



FIG. 129



FIG. 130

FIGS. 128, 129, and 130.—Topsail-halyard toggle.

sails, for slings around gaffs or spars, for hoisting, and in a variety of other ways which will at once suggest themselves to the boating man.

The most difficult of ending knots and one which you should certainly learn is the "Matthew Walker" (Fig. 131), also known as the "Stopper Knot." To form this

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splendid knot, pass one strand around the standing part of the rope and through its



FIG. 131.—Matthew Walker (making)

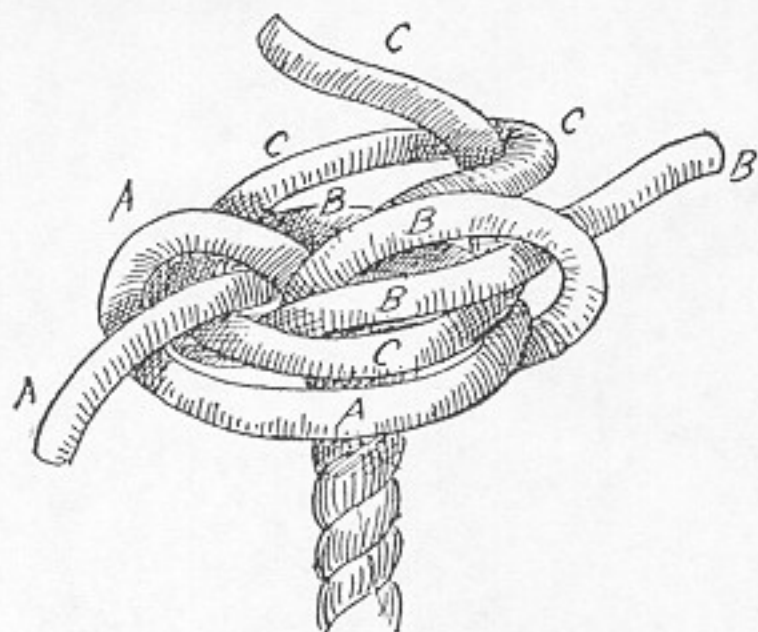


FIG. 132.—Matthew Walker (complete but slack).

own bight, then pass *B* underneath and through bight of *A*, and through its own

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bight also; next pass *C* underneath and around and through the bights of *A*, *B*, and its own bight. The knot will now appear as in Fig. 132, but by carefully hauling the ends around and working the bight taut a little at a time the knot will assume the appearance shown in Fig. 133. This is a handsome and useful knot and is widely



FIG. 133.—Matthew Walker (complete).

used on ends of ropes where they pass through holes, as for bucket handles, ropes for trap-door handles, chest handles, etc. The knot is well adapted for such purposes, as it is hard, close, and presents an almost flat shoulder on its lower side.

The "Turk's Head," Figs. 135 and 136, is a knot much used aboard yachts and warships and is so handsome and ornamental that it is a great favorite. It is used in

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ornamenting rigging, in forming shoulders or rings on stays or ropes to hold other gear in place, to ornament yoke lines, and for forming slip-collars on knife lanyards. It is also used to form collars around stan-

chions or spars, and, placed around a rope close beneath a man-rope knot, it gives a beautiful finish. When made of small line sailors often use the Turk's Head as a neckerchief fastener. Although so elaborate in effect, it is really an easy knot to make, and while you may have difficulty in getting it right at first a little patience and practice will enable you to become proficient and capable of tying it rapidly and easily in any place or position. To make a Turk's Head, have a smooth, round stick, or other object, and some closely twisted or braided small line. Pass two turns of the line around the rod, *A*, Fig. 135, from left to right, and pass the upper bight down through the lower and reeve the upper end down through it, as at *B*. Then pass the bight up again and run the end over the lower bight and up between it and the upper bight. Turn the upper bight again through the lower one and pass the end over what is now the upper

90

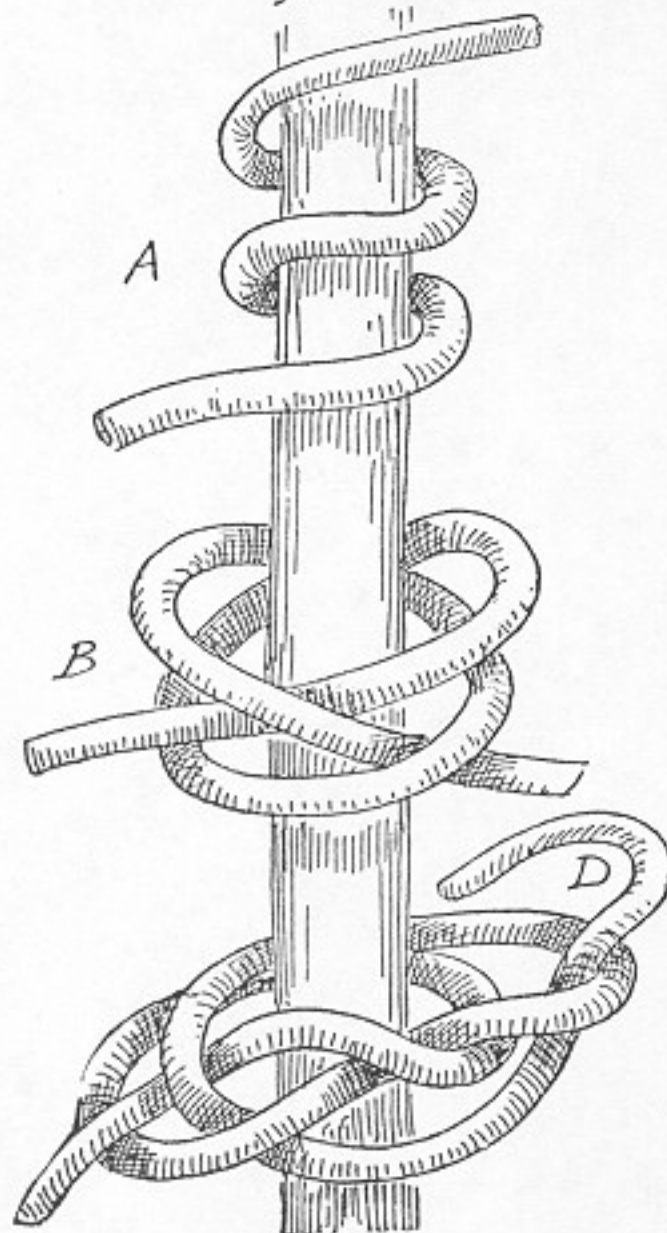


FIG. 135.—Making Turk's head.

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bight and between it and the lower, C, Fig. 135. Now work from left to right, following the lay of the knot (or, in other words, passing your long end alongside the first end), D, Fig. 135, until a braid of two or



FIG. 136.—Turks' heads.



FIG. 137.—Turk's cap.

more lays is completed, as shown in Fig. 136. The Turk's Head may be drawn as tight as desired around the rope, or rod, by working up the slack and drawing all bights taut. A variation of the knot may be formed by making the first part as described and then

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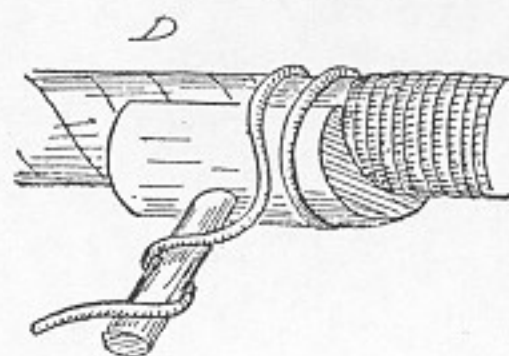
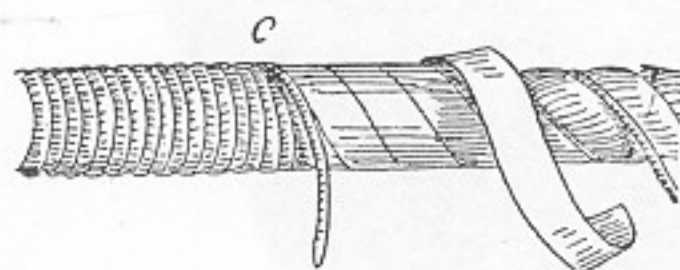
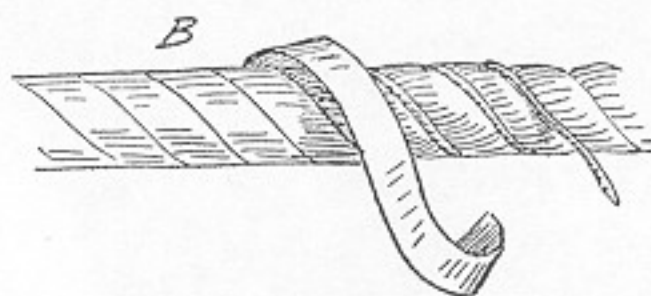
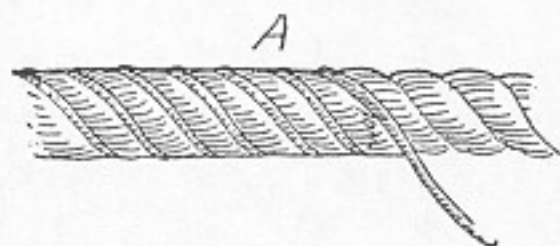


FIG. 138.—Worming, parcelling, and serving.

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by slipping the knot to the end of the rod; work one side tighter than the other until the "Head" forms a complete cap, as shown in Fig. 137. This makes a splendid finish for the ends of flagpoles, stanchions, etc.

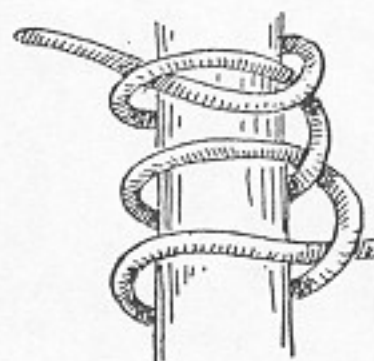


FIG. 139.—Half-hitch work. FIG. 140.—Half-hitch work.

Ropes that are to be used as hand-lines, stanchions, man-ropes, railings, or in fact wherever a neat appearance counts, are usually wormed, served, and parcelled. Worming consists in twisting a small line into the grooves between the strands of rope, A, Fig. 138. This fills up the grooves and makes the rope smooth and ready for serving or parcelling. Parcelling consists in covering the rope already wormed with a strip of canvas wound spirally around it

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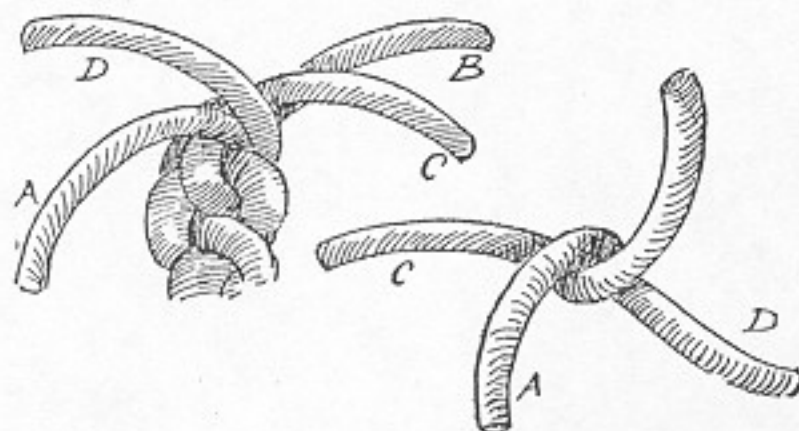


FIG. 141.—Four-strand braid (making).

with the edges overlapping, *B*, Fig. 138. Serving is merely wrapping the rope with spun yarn, marline, or other small stuff, *C*, Fig. 138. Although this may all be done by hand, yet it can be accomplished far better by using a "Serving Mallet," shown in *D*, Fig. 138. This instrument enables you to work tighter and more evenly than by hand, but in either case you must have the rope to be served stretched tightly between two uprights. Often a rope is served without parcelling and for ordinary purposes parcelling is not required. A variation of serving is made by "half-hitch" work, as shown in Figs. 139-140. This is very pretty when well done and is very easy

⁹⁵
to accomplish. Take a half-hitch around the rope to be served, then another below it; draw snug; take another half-hitch and so on until the object is covered and the series

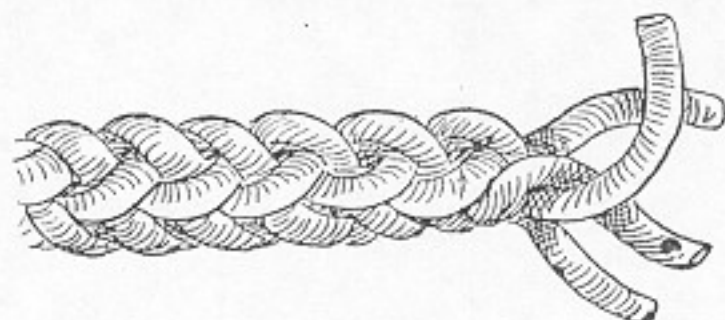


FIG. 142.—Four-strand braid (complete).

of half-hitch knots forms a spiral twist, as shown in the illustrations. Bottles, jugs, ropes, stanchions, fenders, and numerous other articles may be covered with half-hitch work; and as you become more expert



FIG. 143.—Crown-braid.

you will be able to use several lines of half-hitches at the same time. Four-strand braiding is also highly ornamental and is easy and simple. The process is illustrated

⁹⁶

in Fig. 141, and consists in crossing the opposite strands across and past one another, as shown in *A*, *B*, *C*, Fig. 141. Still

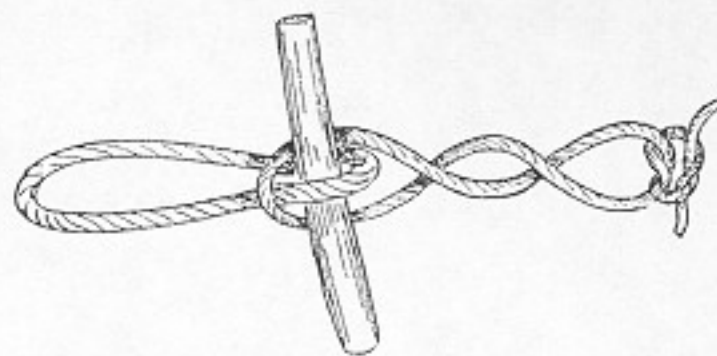


FIG. 144.—Rope buckle.

more ornamental is the "Crown-braid" which appears, when finished, as in Fig. 143. The process of forming this braid is exactly

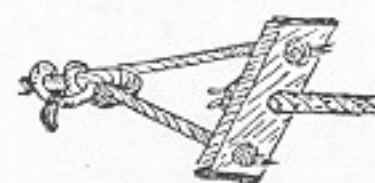


FIG. 145.—Swivels.

like ordinary crowning and does not require any description; it may be done with any number of strands, but four or six are usually
⁹⁷
as many as the beginner cares to handle at one time.

When the rope-worker has mastered all the knots, ties, bends, hitches, and splices I



FIG. 146

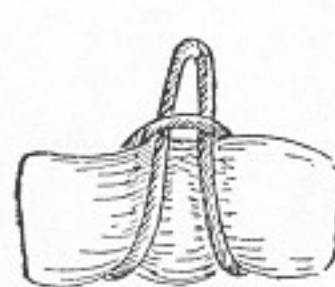


FIG. 147



FIG. 148

FIGS. 146, 147, and 148.—Slings.

have described, he will find a new field open

to the use of rope in innumerable ways. Barrels, casks, bales, or other objects may be roped, or slung, with ease and security; ropes will be pressed into service for straps

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and belts; and buckles may be readily formed by the simple expedient shown in Fig. 144. If a swivel is required it can be arranged as shown in Fig. 145, while several simple slings are illustrated in Figs. 146-148. In a factory, or machine shop, rope belting will often prove far better than leather, and if well spliced together will run very smoothly and evenly even on long stretches. As a recreation for killing time aboard ship, or on rainy vacation days, few occupations will prove more enjoyable than tying fancy knots and making new splices and bends or inventing new variations of the numerous hitches, ties, and knots you already know.

HALTERS FOR ANIMALS

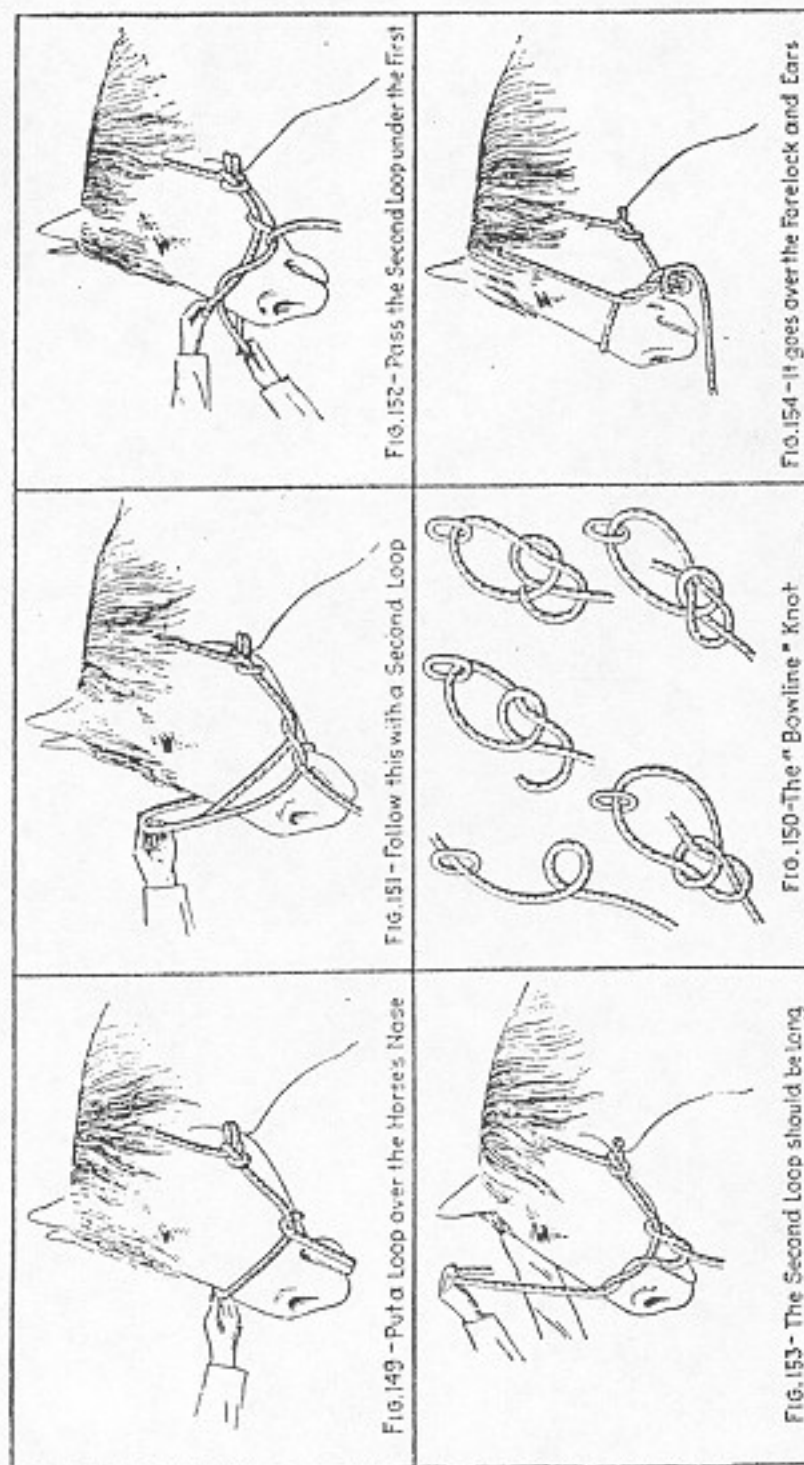
Every now and then a temporary halter is needed for a horse, and in Fig. 149 such a halter is shown. This halter is made by putting the end of a long rope around the neck of the horse and then tying a common bow-line knot. (See Fig. 150.) Fig. 151 shows the second step to be followed, that of passing the rope around the animal's head twice, while Fig. 152 shows how

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the second loop is passed under the first. In Fig. 153 the rope is shown sufficiently

long enough to enable it to be passed over the ears of the animal and leave the halter completed, as shown in Fig. 154.

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SOLAR REFLECTORS FROM AUTO HEADLIGHTS

My printer gave me this ingenious use for old auto headlights. The lens or covering glass is carefully broken from around the edges of the bowl. The metal element is then removed. The bowl will then catch the sun and light tinder and such to make a fire. You might experiment with several of these headlight bowls. You can get them from junked cars.

They work on the same principle as any parabolic reflector. Just hold the tinder at the end of a stick a few inches from the bottom of the bowl while it is facing the sun. Move the tinder up or down to where the main heat is reflected.

Nail Held by Paint Brush for Driving

One workman who has tried many methods of holding nails to drive them in hard-to-reach places, claims that a small paint brush beats them all. The nail is inserted into the bristles, which hold it firmly, yet are pliable and permit the nail to be driven almost its full length before removing the brush.



New Stencils and Their Use

A Practical Working Method for the
Average Painter and Decorator

By
F. N. VANDERWALKER

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PREFACE

In offering this work it is the author's hope that the organized, orderly presentation of the essentials of good stencil work will assist in solving the problems of furnishing better decoration for the average moderate-cost home, the average church, lodge hall, and small theater. That is an important field. The number of such jobs far exceeds that of the more expensive homes and finer public buildings.

Likewise it is expected that the subject matter and illustrations presented here will be of more service to the average painter and decorator than to professionals.

To keep the text matter well within the form of a practical working method, it has not been permitted to become too technical nor too artistic. To produce a work for the use of painters without experience in this line, and those who have little experience, was the accomplishment sought.

SECOND EDITION

The stencil, being a tool in use for centuries, has not changed at all as to principles of design and use since the first edition. Great change and improvement, however, are noted in the artistic value of modern stencil designs. Old classic forms remain unchanged, of

course, and as beautiful as ever, but contemporary designs now conform more nearly to requirements of art in the matter of balance, rhythm, proportion, line and mass. These designs on architectural and furniture surfaces are far more interesting also, because the method of placing them, their size and their colorings are all more artistic. A number of these modern designs used in a modern way are included in this revision.

THE AUTHOR.

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New Stencils and Their Use

CHAPTER I

THE VALUE, USE AND ABUSE OF STENCIL DECORATION

The possibilities for artistic, inexpensive decoration by means of carefully colored stencils are great; and wherever exact and constant repetition of a pattern is wanted, the stencil is the practical, economical means.

Stenciled ornament is not a passing fancy, but an established mode of decorating that comes within the ability of painters who are ordinarily skillful with brush and color. In the design, color, and placing of stencils the decorator and house owner have a wide latitude in which to exercise individual taste and to put together decorations that exactly fit any particular room or suite of rooms. It is really surprising to note the variety of beautiful effects that can easily be accomplished with a little study and practice by the manipulation of designs, colors, and stencil location. They may be adapted to decorate almost every room in a home, as well as public buildings, in excellent taste. In recent years the able handling of stencils by well-known Chicago and New York decorators has placed this class of work easily among the fine arts of this country.

Use in Home Decoration.—Stencils today are used in home decorations chiefly to serve one of two purposes: First, to furnish the only and complete decoration or ornamentation for a room. In this case the stencil may be quite elaborate and colorful, although not necessarily

so, as for many rooms the simple treatment is most artistic, even when they lack interesting architectural features, such as mouldings, coves, cornices, and rails. At any rate, when an attempt is made to elaborate the ornament to relieve severely plain, uninteresting wall spaces, it ought never to be permitted to become gaudy and showy in design and color, producing the circus-wagon and dime-museum effect.

The second purpose for which stencils are now largely used is that of supplementing architectural ornament built into the walls and ceilings—cornices, mouldings, plaster relief ornaments, and the like. Under these circumstances, stencils ought to form a treatment in design, size, proportion, and color which will be incidental and subordinate to the architectural ornament. It must not even pretend to compete with it for attention, but simply adds the needed touch of color.

When in doubt as to how extensive a stencil treatment ought to be carried by any room, it is well to choose the lesser plan every time. Too much ornament does not have the appearance of enrichment, but of intemperance, of being overdone and even vulgar. No ornament at all is better than that.

Use in Theaters and Stores.—Many of the best jobs of stencil decoration in the theaters, dance halls, cafes, and city shops are thought by most people and some painters to be freehand art. They do not, perhaps, note details of construction, but are interested only in the general effect. Artistic these jobs certainly are, but the means of production were mechanical; namely, the stencil, lining fitch, and straight-edge. The designing, planning, and making of specifications for these examples of fine applied art, rather than the execution of the work, are to be credited for their success, although skill in transferring the stencil impressions, in filling in and wiping out the colors, is vitally important.

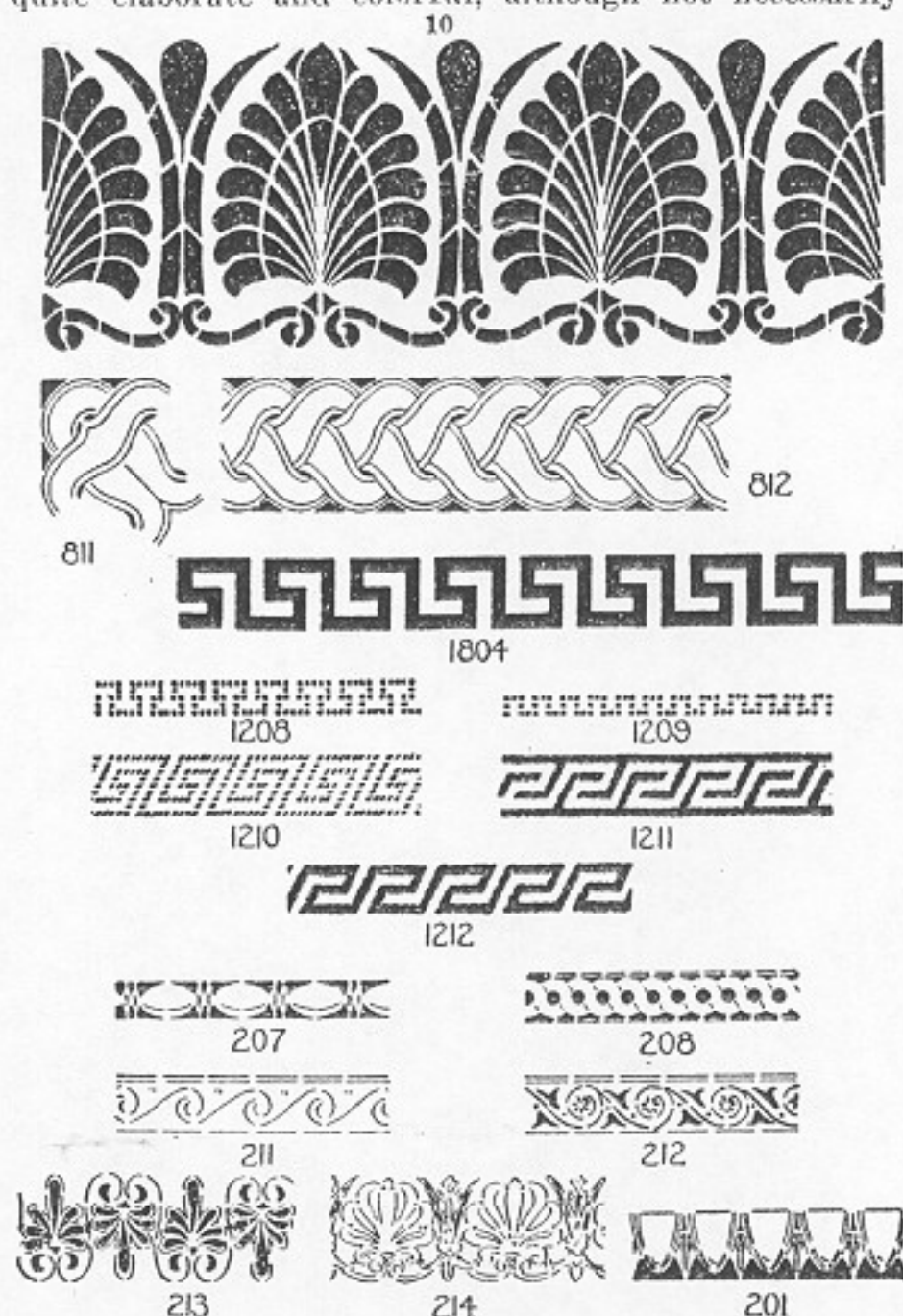
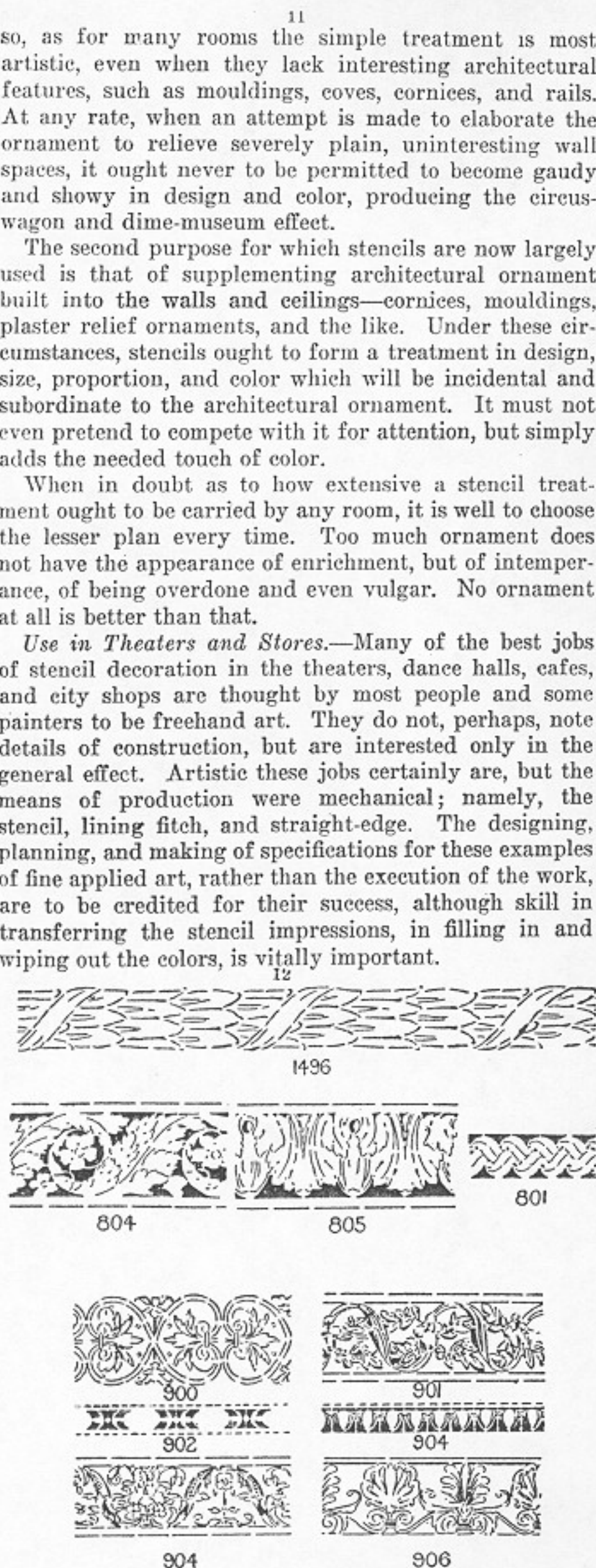


Plate 1.—Formal or Classic Designs for Stencils, Including Greek Frets or Greek Key Designs (center).



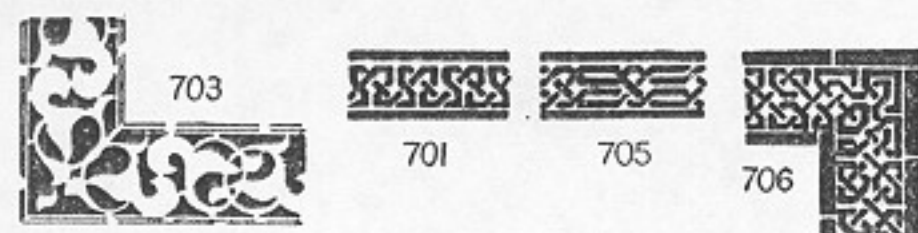


Plate 2.—Classic Stencil Designs, Continued: Roman (top); Renaissance (center); Moorish (bottom).

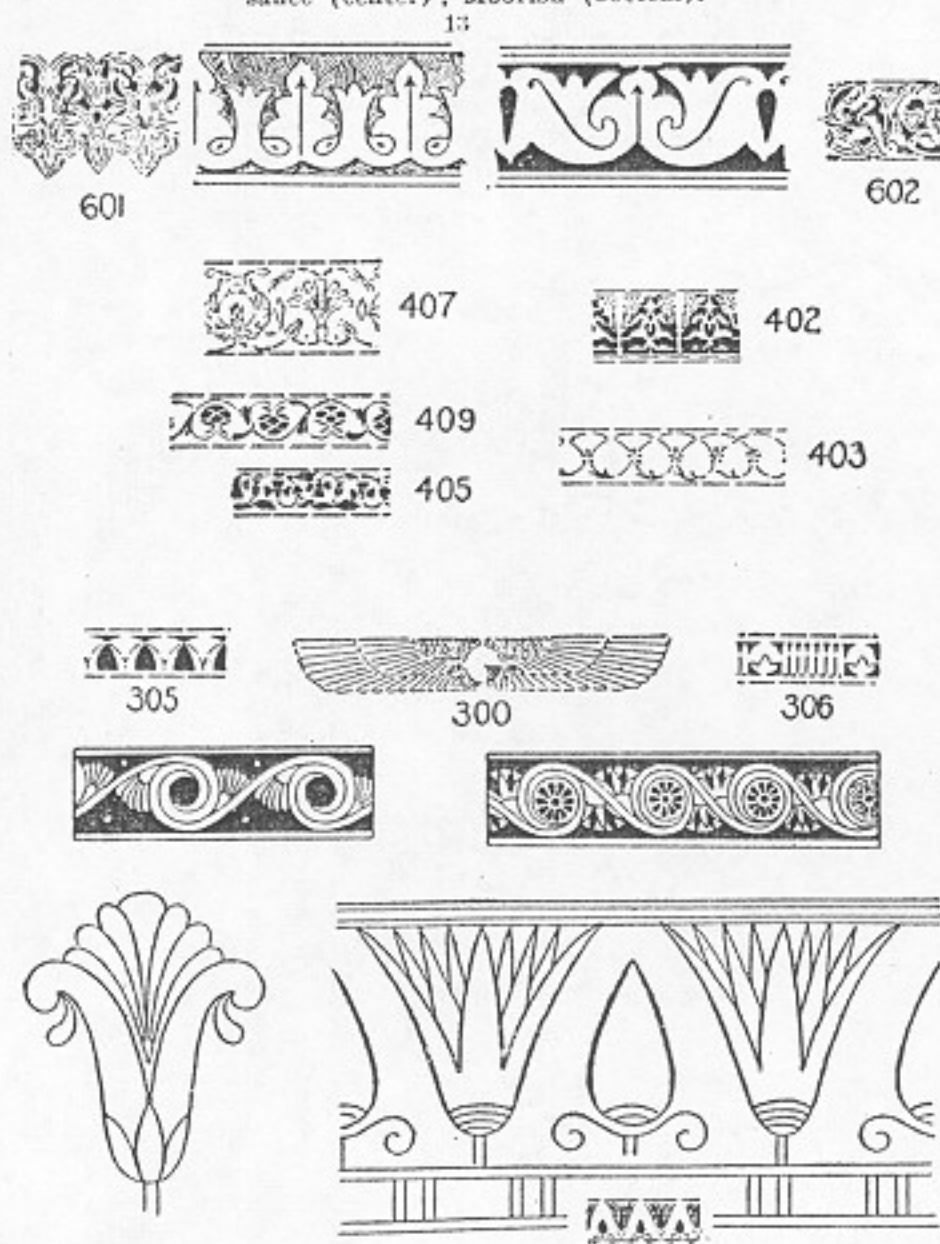


Plate 3.—Classic Stencil Designs, Continued: Arabian (top); Persian (center); Egyptian (bottom).

Abuse of Stencils.—Now, as to the abuse of stenciled ornament little need be said. All have seen it. The careless, shiftless practices of some painters in the use of stencils have done much toward discrediting one of the oldest and most useful arts.

Before the days of wallpaper, "diaper" stencils were much used to produce an all-over pattern on walls. At the same time quick, cheap work was done in distemper (water color), and so the stencils too were transferred with water color, in extravagant, outlandish colors.

We also had a violent fling at unwise stencil use in the period of fresco popularity, when most unpardonable crimes against good color use were committed in wholesale quantities. Never shall we outlive the memory of the vivid greens, brilliant reds, and other howling, screeching colors in which stencil bands were carelessly painted in public places of the less expensive type.

True, there has been much really beautiful distemper decoration, and bad stencil and color use has occurred

with oil colors as well as water colors.

Another manner in which the artistic possibilities of stencil decoration have not been realized, is through injudicious selection of designs. It is difficult to understand why anyone could select a stencil composed of nothing but meaningless scrolls, dots, dashes, and holes, without balance, proportion, and form, when there are easily within reach so many really beautiful classic designs by artists of other times—patterns which are interestingly symbolic of the religions, ethics, ideals, and accomplishments of nations at times when the world was more artistic than now.

We have today also the choice of multitudes of patterns of conventionalized nature. The flowers, leaves, insects, and birds have given subjects of universal interest, and many really beautiful stencil designs have been produced from these subjects.

CHAPTER II

CLASSIFICATION AND SELECTION OF STENCILS

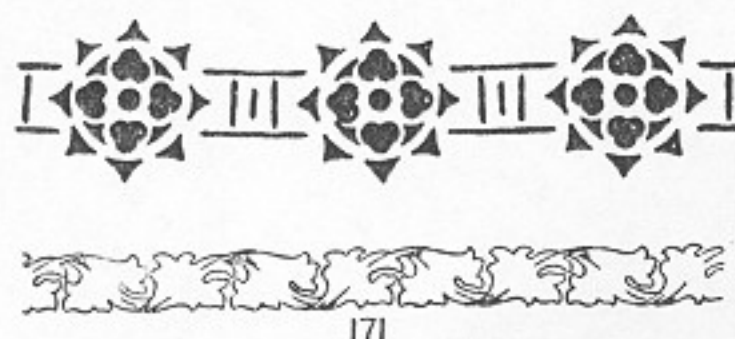
Many really fine stencil designs are offered to the paint trade. There are some, however, which are crude in design and carelessly cut. As between good designs the necessity of selecting appropriate patterns requires your best effort in an attempt to choose the right stencil, both as to color and pattern, for each room, according to its architecture and the purpose for which that room is used. It is not, however, necessary to be an authority on historic ornament, or an artist of note, to use stencils artistically and to excellent advantage.

Briefly, choose designs that are simple and clear; avoid complicated, uncertain figures. Choose designs of recognized artistic merit, rather than odd scrolls, squares and circles which one has never seen nor heard of before, and may never again.

Do not use strong, gaudy, ragtime patterns, but try to select such as produce a refined, artistic effect when carried out in carefully studied colors. Poorly selected and colored stencils make a messy, mussy room.

Classical designs are artistic, interesting and have stories attached to them known more or less to everyone; they are of common interest to all.

Plates 1, 2, 3, and 4 show a few classic designs which are perhaps typical of their periods—the Greek, Roman, Renaissance, Arabian, Moorish, Egyptian, Persian, and Gothic. A study of these is worth while, as a knowledge of the best and most beautiful of other times is the only basis for good judgment of what is good and bad in present-day designs. Some of these are ordinary one-



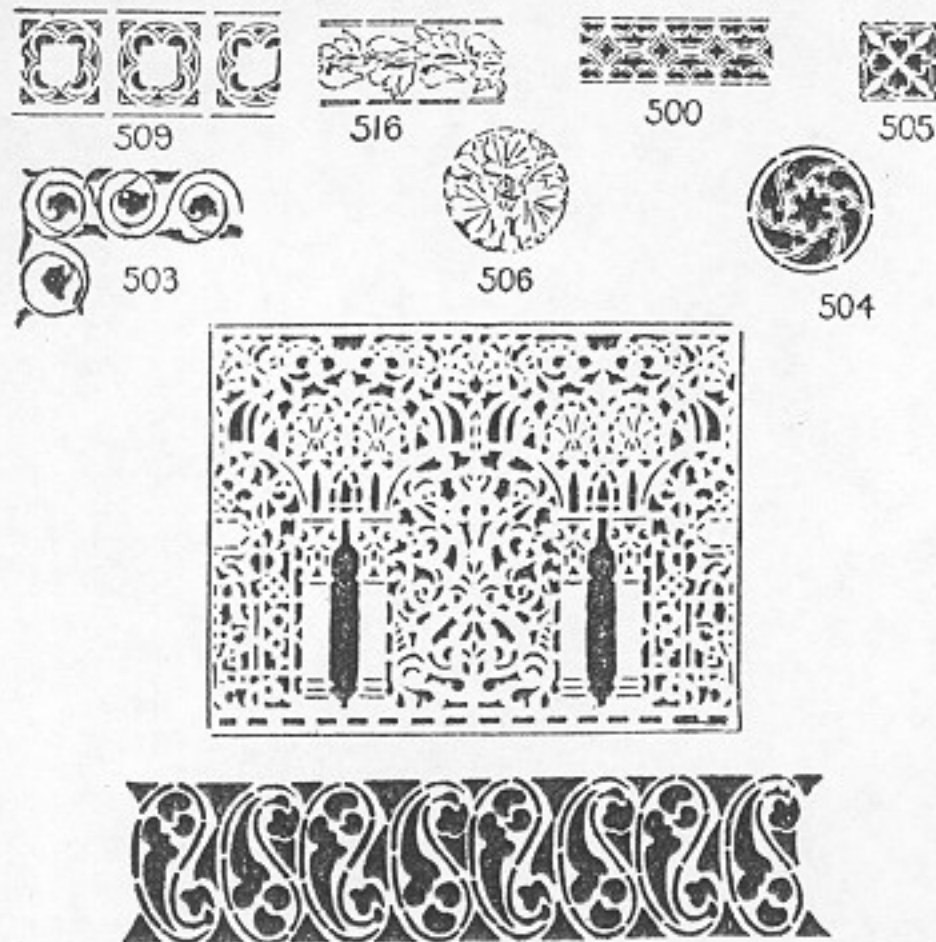


Plate 4.—Classic Stencil Designs, continued: Gothic (above) and Oriental (below).

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color stencils as to form; some are outline stencils, and some background stencils. Plates 35, 36, 37, and 38 show many attractive modern English, French, American and Japanese stencil designs.

Of the modern stencils, those which are most likely to be of good design and well balanced are the simple motifs of conventionalized flowers, leaves, vines, etc. When you have looked over the patterns shown in the several plates of this book, you will readily note the character of good designs.

CLASSIFICATION

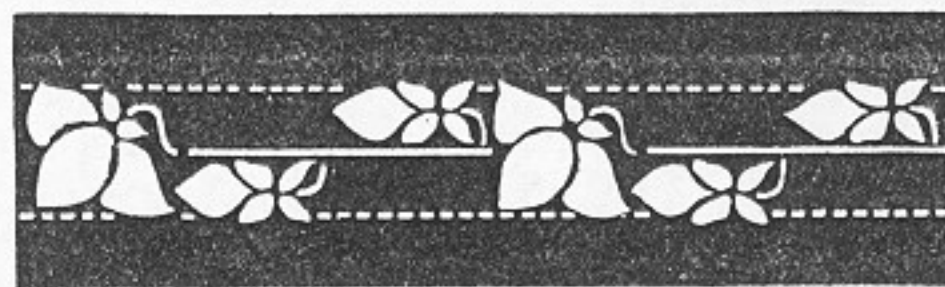
Stencils come naturally within classes known as Ordinary One-Color, Background, Outline, and Color Stencils.

Ordinary One-Color Stencils.—(Figure 1, Plate 5.) This class includes such stencils as are transferred in one operation, and all are familiar with them. A one-color stencil may be made more effective by using different colors, or shades of one color, in different parts of it. This requires but little more additional time in its execution. The different colors must be put in with different brushes.

Suppose the rose design, Plate 17, is to be transferred. A small piece of paper tipped with a spot or two of mucilage would be placed over the flower while the leaves and stems were being transferred in green. Then the paper would be removed from the flower and placed over the leaves and stems while the flower was being transferred in red.

Background Stencils.—(Figure 2, Plate 5.) Background stencils are quite similar to the ordinary one-color kind, except that in place of cutting out the design, as in Figure 1, when making the stencil plate, the background is cut out and transferred to the wall in color. The wall color shows through or between portions of the

ground color, and forms the pattern. The background, not the pattern, is transferred to the wall in color.



STENCIL PLATE



STENCIL IMPRESSION
Figure 1.



STENCIL PLATE



STENCIL IMPRESSION
Figure 2.

Plate 5.—One-Color and Background Stencils.

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Sometimes a band of opaque color is laid on to the wall, just wide enough to have the background stencil cover it; this colored band is allowed to form the stencil pattern, rather than have the wall color show through. Moorish and other Oriental stencils are effectively used in this manner for churches and lodge halls.

For instance, suppose the wall to be stenciled is a light warm gray. Mark off with a pencil and straight-edge a band of six or eight inches wide (exactly the same width as the stencil pattern), parallel to and below the picture mould or just above the chair rail. Fill in the band between these lines solid with a fairly bright but soft red paint, made by tinting white lead with American vermilion and a touch of chrome yellow. Or, for a semi-transparent red band, simply use the American vermilion alone, fairly thin. When this band of paint is dry, transfer the stencil impression on top of it, using perhaps ivory white paint for a good effect. A touch of ultra-

marine blue on the center figures would help bring out the right effect for this Moorish design.

The most simple use of these stencils is to transfer them in a darker or lighter shade of the wall or ceiling color, as the case may be. A background stencil transferred in dull blue on an ivory wall or band of color makes an attractive color scheme.

Outline Stencils.—(Figure 3, Plate 6.) As the name indicates, this outline stencil is merely a light outline of a design that is transferred usually with burnt umber or raw sienna to the wall, so as to form a pattern that can be filled in later with two or more colors.

In Tiffany wall glazing, the outline stencil is transferred to the wall when the second ground coat has become dry. The stencil is permitted to dry before your first glaze color is applied. When the glaze color has been blended out, wipe all color from within the lines of the stencil before it becomes dry. The object of this is to

have the flat ground coat show through the outline stencil and form a light uniform surface upon which to fill in stencil colors when the glazing coat is dry.

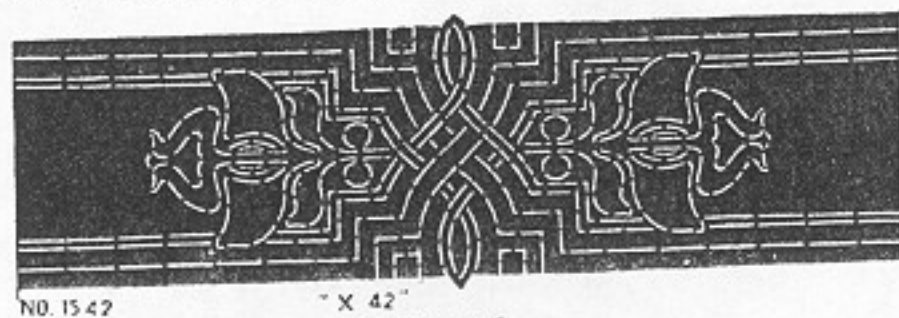


Figure 1.

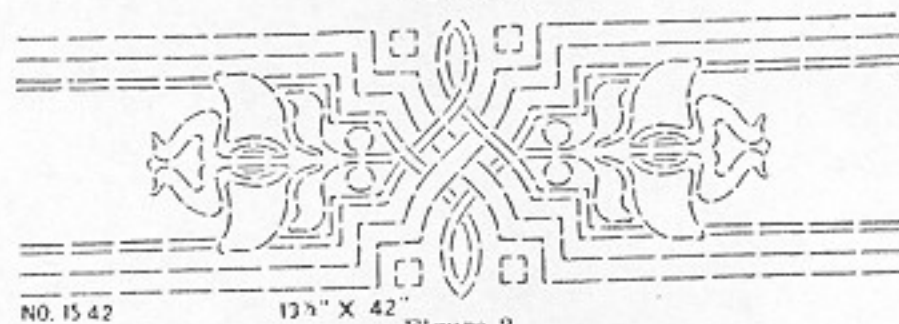


Figure 2.



Figure 3.

Plate 6.—Outline Stencils.

Often outline stencils are transferred in some light, soft color (such as a light but dull blue on an ivory ground) and left in that condition as finished. No other colors are filled in.

Tie-Less Stencils.—(Plate 7.) Double stenciling makes it possible to transfer practically any design without showing the ties. The Greek Key shown is an example

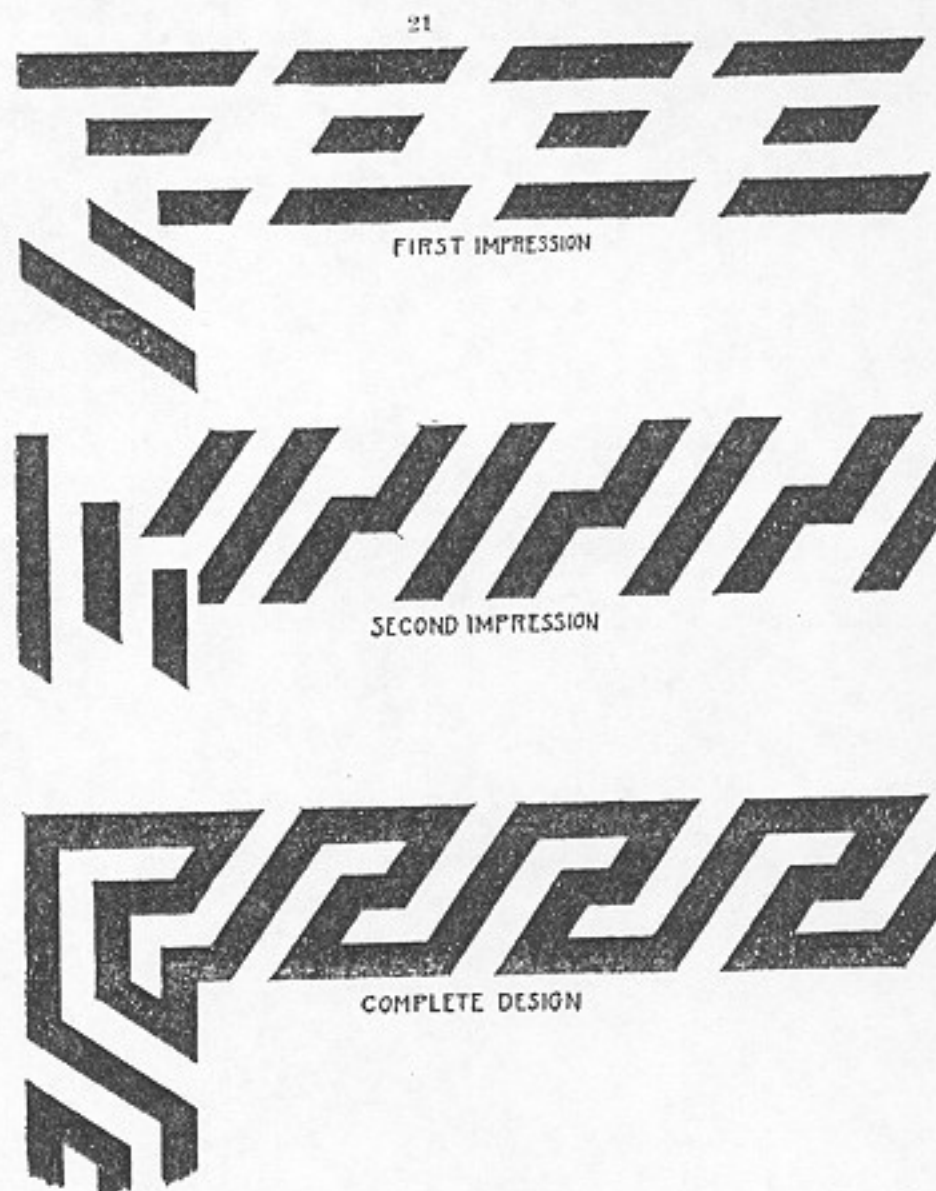
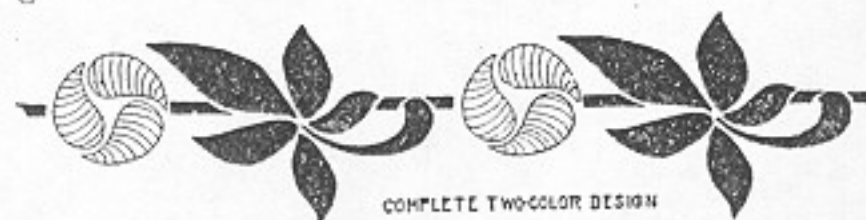


Plate 7.—Greek-Key Design for Double Stenciling, Using Two Plates
Make the Pattern Tie-less.

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of a stencil that cannot be transferred with one plate without showing ties, but it could be transferred from one plate and the ties painted out with a small fitch. Another way is to make two plates, which will transfer the design complete in two operations and without showing ties.



COMPLETE TWO-COLOR DESIGN



STENCIL PLATE—FIRST COLOR



STENCIL PLATE—SECOND COLOR

Plate 8.—Color Stencils for Two-Color Work. G, G, in Lower Stencil,
Are Guide Marks.

With certain stencils that have many figures, or complicated patterns, it is often better to transfer them by means of two different plates than to attempt to make the entire design on one plate, thereby causing a great many ties and producing a frail stencil that is too intricate and delicate to withstand the transferring process more than a few times.

Color Stencils.—(Plate 8.) These should not be confused with outline stencils. Both kinds produce a finished design in colors. The outline stencil, Plate 6, however, must be filled in freehand with colors, using small brushes, while the color stencil, Plate 8, is transferred in two operations from two plates, using a different color and stencil brush with each plate to be transferred.

Note the guide marks *G, G*, on the stencil plate for the second color. They consist of the tip of the lower leaf on the right-hand side of the completed design, also the tip end of the upper leaf in the upper left-hand corner. When the second color plate is placed upon the surface (after the first color has been transferred to the wall), these ends of the leaves enable the decorator to place the second color plate in exactly the right location to bring the balance of the design where it should go to complete the work. When these guide marks or holes are placed precisely over the leaf ends of which they are a part, the second color plate must of necessity register perfectly with the part of the design placed on the wall by the first plate.

Ordinary one-color stencils are often used for two and three-color effects, simply by transferring all colors at each setting of the stencil. A brush for each color is needed. The parts to be colored with the second color are covered with the hand, a piece of tin, or paper, while the first color is being put on. Then the first color is covered while the second color is being applied.

Sometimes one color is put on over another at the same setting of the stencil; that is, the leaves of a flower pattern, for instance, may be filled in with light green all over and then a darker green may be put on over it to the lower edge or base of the leaf. This gives a nice effect.

DIAPER AND ALL-OVER STENCILS—(PLATE 9)

Time was when the all-over pattern stencils were much used to decorate large wall areas. They are used oc-

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casionally today for unusual effects, but wall paper has largely displaced the all-over stencil method, because it requires much less labor. Some of the older expert decorators probably will never agree that wallpaper decorates as well as the all-over stencil in the hands of skillful men, but the saving of labor means dollars saved and the wallpaper is good enough for most jobs.

With diaper and all-over patterns the wall must first be accurately marked off into squares, circles, hexagons, or sections with diagonal, parallel, or vertical lines, using chalk lines, according to the shape and size of the stencil.

The idea is simply this: You cut or secure a stencil, of small size as compared to the wall—10"x15" or

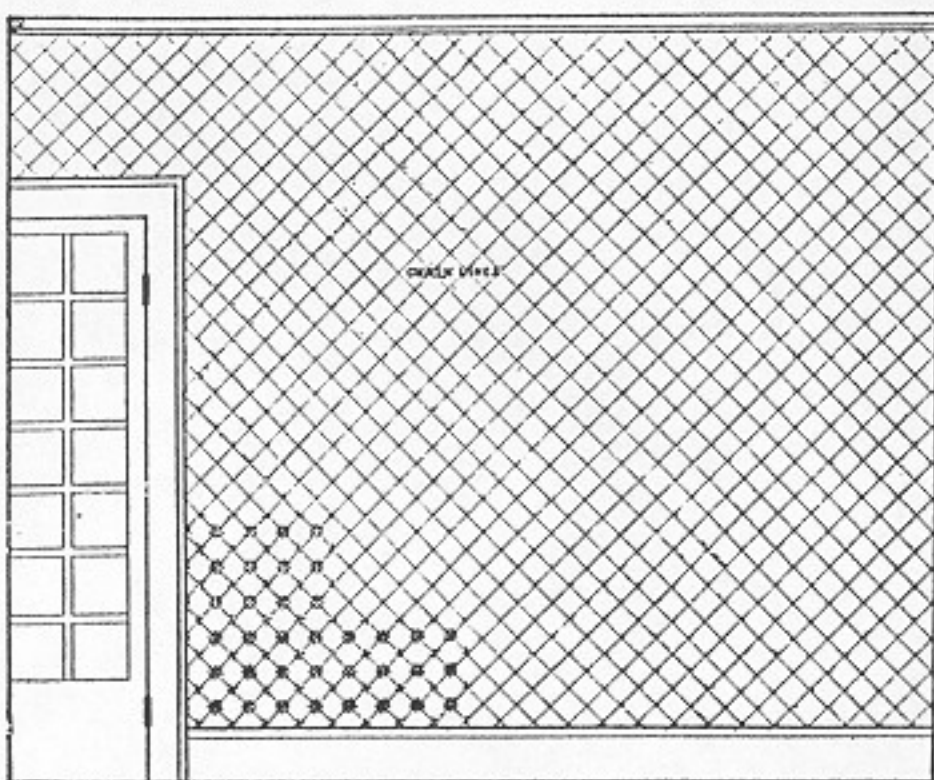
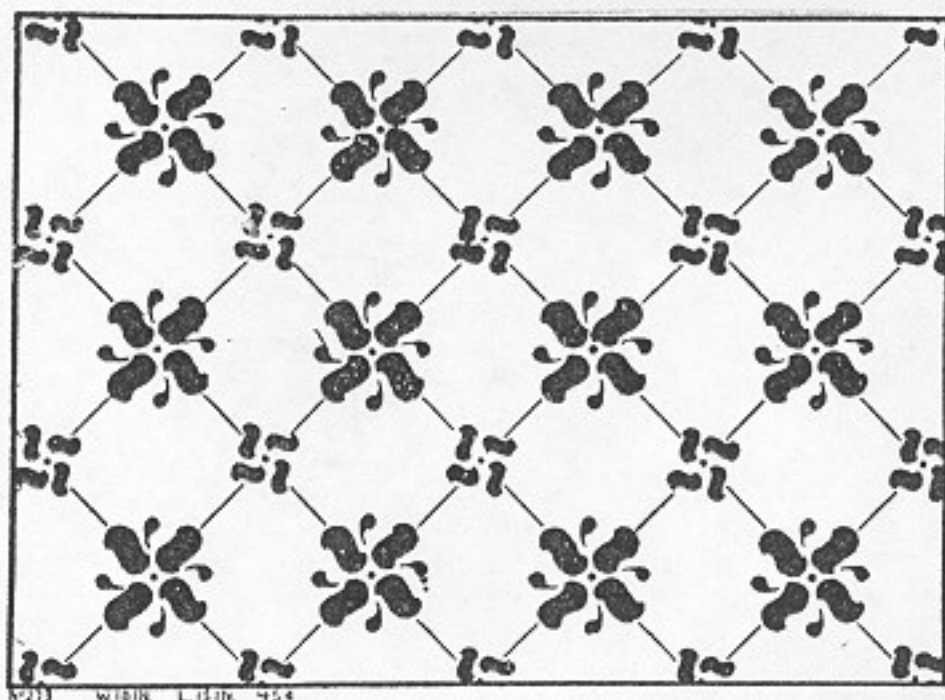


Plate 9.—Diaper Stencil, with Wall Prepared for All-Over Stenciling, and Work Started in Lower Corner.

10"x20". Then mark the wall off into sections the same size and shape as the stencil. The stencil impression is then transferred to the first wall section, to the second, third, and so on until the whole wall is completely covered with repeats of the one stencil.

Plate 9 shows a suitable diaper stencil, also a wall marked off with chalk lines and then partly filled in with a stencil pattern.

Usually the same stencil pattern is repeated in each section until the whole wall is covered, but sometimes two different stencils and patterns are used alternately. Whatever kind of all-overs are used, extreme care is necessary in matching accurately and joining up each setting of the stencil on all four sides. Also the amount of color on the brush must be kept constantly the same, to produce uniform work.

It hardly need be pointed out that all-over patterns are usually stenciled in a lighter or darker shade of the same color as the wall is coated with; a dark cream stencil on a light cream wall, a light gray stencil on a darker

gray wall,—thus producing harmony of color by analogy, or likeness of related colors. Not necessarily so, however.

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Harmony by contrast, the use of different colors which do not clash, is often to be preferred.

A light olive green stencil, such as the one shown in Plate 9, on an ivory wall, makes a combination which is beautiful beyond imagination. Likewise, just the right shade of pink for the light pattern spot stencil, Plate 10, on a light, warm gray wall, is indeed attractive for a bedroom. Decoration produced in this manner, by using

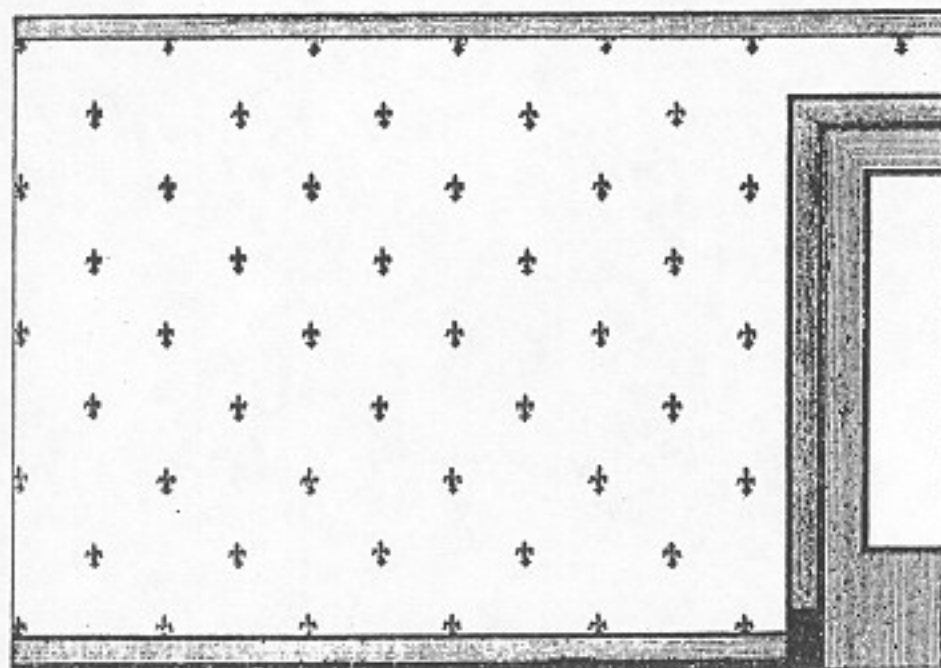


Plate 10.—Spot Stencil Suitable for Bedroom Decoration.

light, open, spot stencils to form an all-over pattern, is charming to a degree impossible to be equaled by wall-paper patterns of even the most expensive class. Time was when the large figured and heavily colored patterns of all-over stencils were preferred, but nowadays there can be no doubt that the light-lined, airy, and delicately colored stencils are much preferred.

Single-Spot Patterns.—The use of single-spot stencil patterns of symmetrical or conventional nature designs

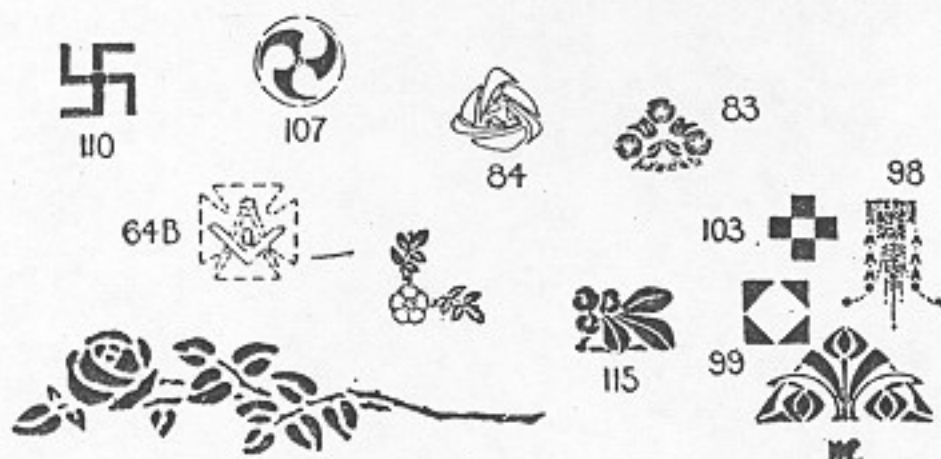
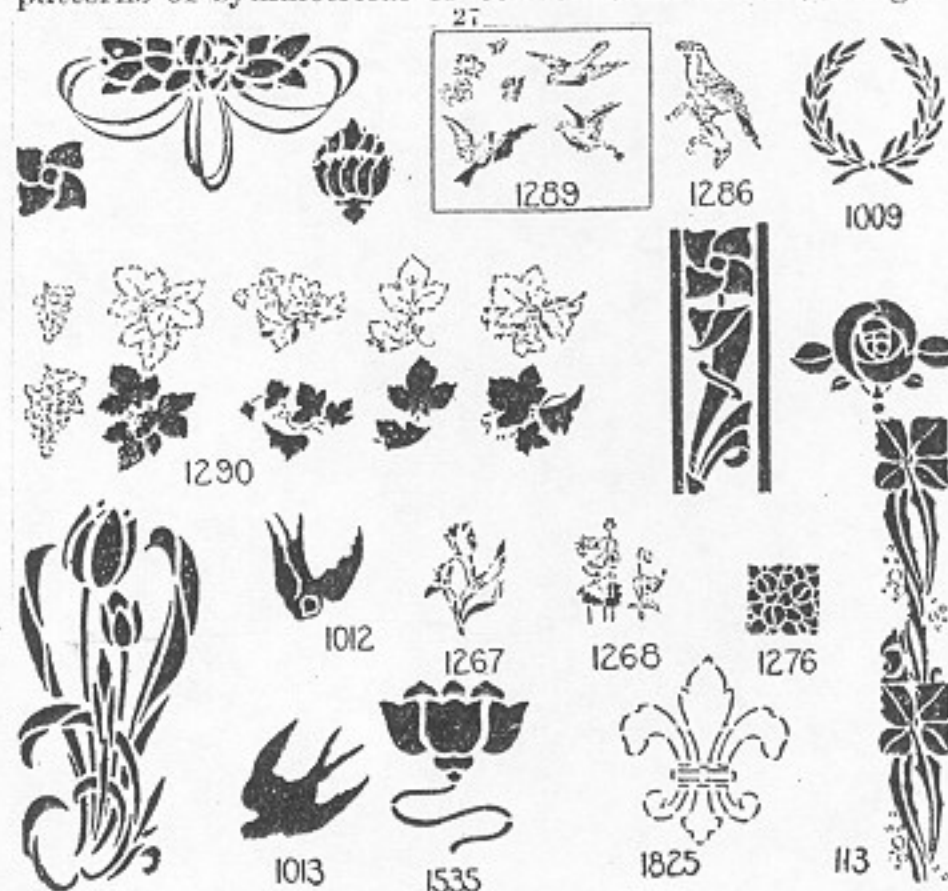


Plate 11.—Single Spot Stencil Patterns.

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offers an unlimited field for skillful decorating. Plate 11 illustrates a few such designs. The surface, after being ground-coated and finished as for plain colors, would be marked off in squares, rectangles or diamond sections, as in Plate 9, and the stencil pattern transferred to the wall at the intersection of the lines. Not necessarily at every intersection. The design may be placed at every other intersection, or every third, as may make the best appearance. One or two designs may be used (if they look well together), or a single design may be repeated to fill the whole wall space.

Detached Stencils.—These really do not form a separate class of designs. The term refers to a little different use of an ordinary stencil motif, or it may be a color stencil, an outline or background stencil. One or more separate motifs, such as are shown on Plate 11, are placed in the corners of panels, at intervals in the frieze, on the wall, or in some such manner, and are then connected by lines or band stencils. In other words these individual designs may be used on any area once, or repeated many times, and are usually, but not always, connected with narrow lines or a running pattern of stencil.

Plates 10, 21, 26, 28 indicate some of the uses made of detached designs. After some experience and study the decorator finds detached designs to have by far the greatest use of all. There is no limit to the ornamental effects which can be secured with them. They allow much latitude for exercising taste, for making up decorative schemes which just fit each room, and for producing special effects.

CHOOSING A STENCIL DESIGN

Selecting stencil designs which are appropriate for each room to be decorated is fully as difficult as the choice of the correct color effects, and is not less important. The help which others can give you to insure judicious selec-

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tion is also about as indefinite at best as color suggestions and principles.

To be able to choose correct and tasteful designs, you ought to educate yourself to know the various orders in architecture and the style of ornament which was characteristic of each period of art history. With even a superficial knowledge along these lines, you can get on very well. This information is readily to be found in libraries, art institutes, encyclopedias, and illustrated

dictionaries.

What Not to Do.—Further than what has been said and suggested in other chapters about selection and appropriateness of stencils, and their suitableness to the character of the rooms where they are to be used, a word about what not to do may help.

In a building of Oriental architecture use Oriental ornament in stencils, not Gothic or some other order.

Rose or other flower patterns nicely suit some bedrooms and sun parlors, but are ridiculously out of place in an office room.

It is not desirable that designs of fish, game, and other edible things be used in the dining-room just because that is where we eat. Neither is the bathroom the place for nude figures because that is where mortals bathe. The fish and game patterns may be interesting indeed in the gunroom of a club house.

Appropriate Designs.—The living room, reception hall, and library may well be stenciled with a formal classic design, perhaps some of those shown in Plates 1, 2, 3, and 4.

Nicely colored, conventional flower and leaf patterns are pleasing for dining-rooms, as a rule. Sometimes, however, the character of the furniture and the architecture of the rooms make it quite obviously necessary to use a stenciled design of like character.

Delicate, fine-lined stencil patterns fit most ap-

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1593



1598



Plate 12.—Stencil Patterns Appropriate for a Child's Bedroom or Nursery.

appropriately the white enamel, ivory, and gray painted woodwork of bedrooms and the light, natural finished trim of other rooms. Rooms with mahogany furnishings require rather light, graceful stencils.

Where the furniture is heavy, massive oak and the rooms quite large to correspond, the stronger and bolder stencil patterns are suitable.

The interesting bird figure and animal stencils, some of which are shown in Plate 12, nicely fit the child's bed-

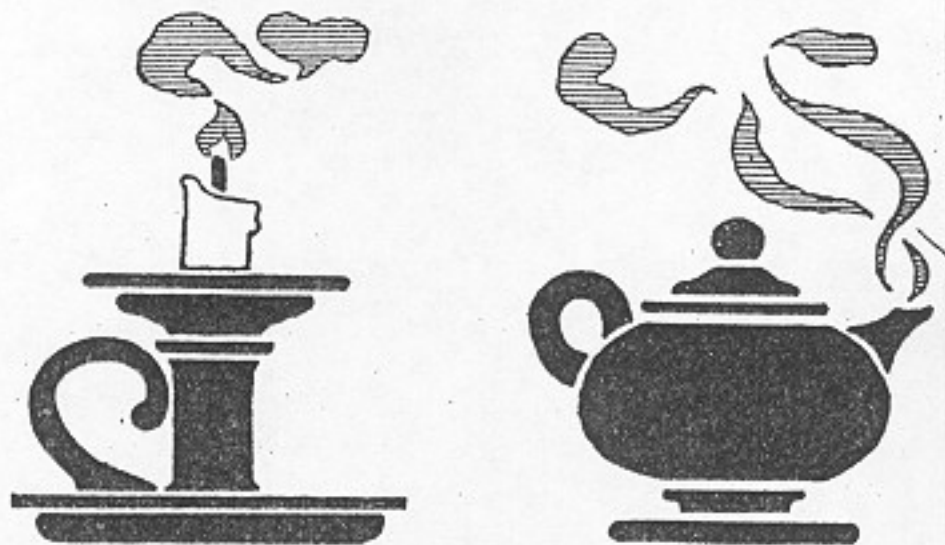


Plate 13.—Candlestick and Steaming Teapot Designs for Bedroom and Dining-room Respectively.

room or nursery and should be placed in a deep frieze at top of wall, or better yet in panels low down, the height of children. The steaming teapot design, Plate 13, carries out a dining-room scheme well, while the candlestick is a pretty pattern for almost any bedroom.

Those who do not care for flower designs in stencils usually are delighted with simple classic designs, delicately and softly colored to harmonize with the wall colors.

The Greek frets, or key designs, in all their variations, and many of the interesting conventional patterns lend dignity to a hallway and are in good taste in living-room, den, library, or public buildings.

Form and Color.—Considering the effect of stencils as a whole, both color and form have their influence. Whether one or the other is more important is difficult to say. The highly developed art of Greek civilization twenty centuries ago believed form to be the most important, and developed form to perfection, to the exclusion almost of color. The Greeks produced only a small number of designs, but gave their entire energies to improving the few to the point of perfection in form. As a result of this concentration, their designs are today standard, widely used and appreciated. Other less perfect art has been forgotten these many centuries.

Form, being more difficult to understand, is probably less appreciated by most people of today, even though it may be more important than color, as influencing our enjoyment of artistic design. Certainly it is true that good coloring of a stencil will be appreciated more on mediocre form in design than poor coloring of perfect form. This is due to the fact that we are developing more rapidly in the art of color than in form.

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CHAPTER III

STENCIL MAKING

A stencil is a design or pattern cut through a thin sheet of paper, zinc, brass or some other flat material, for the purpose of making a tool which will transfer an impression of that design to a surface repeatedly. Plates 5, 6, and 8 show stencils and the designs formed on a surface by their impressions.

Designing.—Until one has had considerable experience using stencils designed by others, no attempt should be made to compose designs. Excellent stencils can be secured conveniently and cheaply from paint supply houses. Until much experience has been gained, designs made by a novice would probably look amateurish and crude.

The use of ready-made stencils is discouraged by many decorators, and they base their advice on sound reasoning in many respects. It is true that stock designs are often used unwisely and with no credit to art. The young decorator, without the benefit of the apprentice system, which is lacking today, must begin somewhere, however, and surely the use of stock designs of merit is to be preferred to the kind an inexperienced man will design to begin with.

By all means learn to design. A special set of stencils to fit each job in size, color, and character of pattern, is the way to produce artistic effects and at the same time get much joy out of one's accomplishments.

To design, draw, and cut a set of stencils for a job is no small task, but rather one which calls for good judgment and good taste in color, form, and balance; also a

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sense of the fitness of things. Such qualities in a decorator come only after careful study, observation, and practice; these constitute experience.

Until you have worked long enough as a decorator to have gained a fair measure of experience, use the best ready-made designs you can purchase; but use them sparingly and see that they fit each job in character. When more than one pattern is to be used, have them fit each other.

Don't be afraid to worry about the suitability of selected stencils. When you worry you think hard, and when you do that you are likely to make the best selections. The success of your jobs depends on your planning, upon the selection of designs, not so much on the execution. Any good journeyman can put the stencils on under clear instructions.

Knowing how to make stencils is valuable chiefly for the purpose of combining detached motifs, bands, runners, and solid lines so as to form a scheme for decorating a room. There are times when two or more good designs can be combined to advantage, when they go well together. Sometimes it is possible also to use certain parts of two or three patterns to form one new design.

Points to Remember.—When making up stencils and schemes for decorating keep these points before you:

1. All parts of a stencil and of a decorative scheme

of lines and figures must balance well. A view of the whole layout should show that neither one side nor the other, nor yet the top or the bottom, is heavily overbalanced by too strong coloring or by wide, thick members. Of course a prominent figure on one side may be balanced by a like one on the other. A predominating central feature may constitute nearly the whole stencil and then be balanced by a like feature in the next position or setting of the stencil.

2. Don't produce a crowded pattern, but don't have the detailed features too few. Blank space is as valuable and necessary as figures.

3. Have your curved lines gracefully curved and positively located.

4. Straight lines, squares, rectangles, circles, and all geometrical figures ought to be carefully measured to locate them. Then accurately rule in and cut. It will pay to spend as much time as is needed, in drawing the first stencil, to secure minute accuracy. Then keep it as a pattern from which to cut other stencils to be used on the work.

5. Keep in mind that a stencil designed to look well on paper, in black and white, will look far different when the impression is put on a colored wall in a color, rather than in black.

6. Do not use the same motifs, nor the same complete stencil designs, for more than one job in a neighborhood. The customer does not like to have his decorations duplicated, at least in the same neighborhood, and there is no need for it.

But, after all is said about using good taste and good judgment to secure nice balance, flowing lines, and graceful contour in your stencil designs, it must be concluded that words are as empty here as when trying to describe a beautiful color or music.

To study diligently the designs of master artists, and then practice, is the sure way to learn to do well on your own account. Fine designs are everywhere to be found—in the encyclopedias, the dictionaries and the hundreds of books on design for many purposes that may be consulted in the libraries. The museums, with their ancient pottery and metal products, also offer an endless opportunity to study the best.

The stencil process is not successful when it comes to transferring designs of animals, birds, and people in their natural state. The features invariably are distorted

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and look freakish. Conventionalized natural subjects and silhouettes are transferred in excellent manner, however.

Conventionalizing.—Natural subjects are extensively used as motifs for stencil schemes, especially birds, insects, animals, and flowers. The Greeks and all civilized peoples since have used greatly the acanthus leaves in varying forms, also the anthemion (honeysuckle). The Egyptians used the lotus flowers, buds, and leaves. The Romans used the laurel leaves, making a crown of honor and symbol of victory. The French have their lily, the Dutch the tulip, the English the rose. All are changed

to formal lines, conventionalized, and used the world over.

Some of these motifs—the rose and tulip, for instance—are much used in outline in their natural form, as well as conventionalized, and when so used ought to be colored naturally, or nearly so.

Plate 14 shows the natural lily with its conventionalized form, the fleur-de-lis, and several other conventionalized motifs.

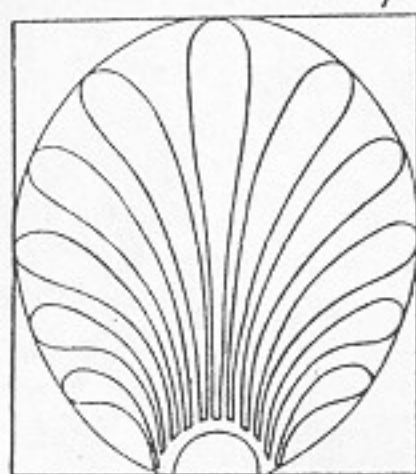
MATERIALS FOR STENCILS

Stencil Paper.—The material almost universally used now from which to cut stencils is a fairly, thin, tough, oiled paper, which can be purchased from paint supply houses in these sizes:

	Per 10 yd. roll	Per yard
Oiled stencil paper, ready for use, 36 in. wide, weight 8 lbs.	\$4.50	\$0.50
Oiled stencil paper, ready for use, 48 in. wide, weight 11 lbs.	6.00	.70
Unprepared paper, 48 in. wide, X.	2.40	.30
Unprepared paper, 48 in. wide, XX.	2.80	.36
Unprepared paper, 48 in. wide, XXX.	3.20	.40
Unprepared paper, 48 in. wide, XXXX.	4.00	.50

The above are "list" prices, and subject to a discount of 50 per cent.

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N2 649 \$ 1.00



1823

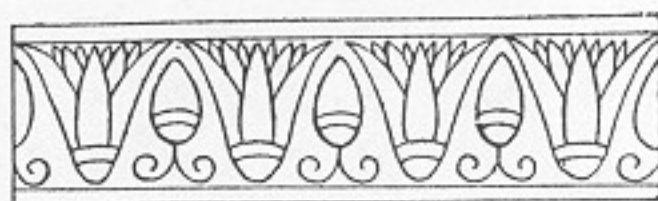


Plate 14.—The Natural Lily and Its Conventionalized Form, the Fleur-de-Lis, with Other Stencil Patterns.

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Coating Ordinary Paper.—It is possible to use ordinary, heavy, brown Kraft wrapping paper with good results. Treat it first with a coat or two of paraffin wax, dissolved in turpentine. Shave the wax into small pieces, put into a pot and cover with turps. Then put the pot into hot water until the wax is dissolved. Do not melt on a fire. It is dangerous.

Another plan is to cut the stencil from this paper and shellac both sides of it. The English decorator prefers to coat all stencils made from paper, first with a mixture of one-third turpentine and two parts linseed oil. Then a coat or two of white lead and turpentine makes a flexible stencil, which lies flat on the surface and does not curl up on the corners nor catch the brush.

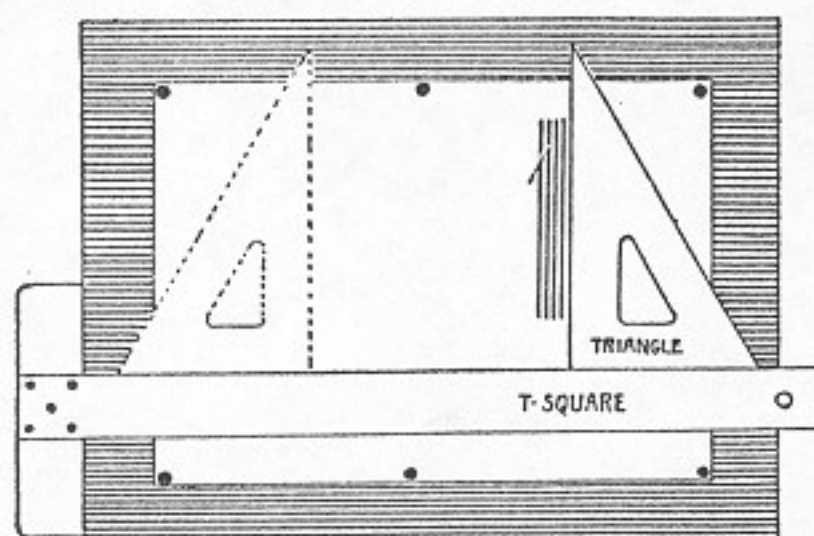
Other Materials.—Stencils to be used as patterns from which to make other stencils, and those which are to receive unusually hard service, are cut from a thin sheet of zinc, brass, or lead. Metal stencils do not lie close to the surface as they should in transferring, but are best for some jobs.

Many other materials are used in making stencils. Window shade cloth is excellent. Wall canvas, oil cloth, and filled muslin make stronger and more flexible stencils than paper. They are, of course, painted and shellacked before using, and usually before cutting.

DRAWING THE DESIGN

The stencil design may be transferred to a new sheet of stencil paper, or metal, with paint through another stencil, making the same kind of an impression as would be transferred to a wall, or it may be drawn through such a stencil with a pencil. Again, the design may be put on to the stencil paper by tracing it through a piece of carbon paper or it may be drawn with rule, compasses, T-square, and triangle.

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CURVES



SCALE

Plate 15.—T-Square, Triangle, Curves, and Scale Used in Stencil Design.

However it is transferred to the paper, have the sheet securely fastened down to a drawing-board (your wife's bread-mixing board will do, if you can get it) with thumb tacks. Be certain to have an accurate rule and a hard pencil—4H or 6H, preferably the first.

Copying Designs from a Book.—Should the design you want to use be found in a book from which the page ought

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not to be torn, or marked up by tracing the design through carbon paper on to the stencil paper, you can copy the design in this manner: Lay a piece of linen tracing paper, such as is used by architects for plans, over the design. Fasten it to the page with paper clips, pins, or thumb tacks, and proceed to trace the pattern with a hard pencil onto the linen, which, of course, is transparent. Thin, white, transparent letter paper, rice paper, and onion-skin paper are just as good for the purpose, but not so tough and durable as linen.

When you have the design on the linen or thin paper, it can be transferred to the stencil paper easily, by placing a sheet of carbon paper between the two and tracing the pattern with a hard pencil. Keep the pencil sharp and follow the lines carefully, or you will lose some of the important details of the design during the transferring process. Study the design carefully before beginning to trace, and then you can do a more accurate job. After tracing, true up the straight lines with a rule and the curved lines with a compass or by freehand.

New Drawings on Stencil Paper.—When making a new drawing on stencil paper, without the use of tracings, and when laying out a new stencil composed of detached motifs or parts of other designs, start your drawing by making a base line square with the board, using the T-square for the purpose. Then use the triangle on top of the T-square for all vertical lines, as in Plate 15, and the stencil will be accurate when finished. That is exceedingly important.

If the stencil design and plate are not the same width at both ends, the design will not match and will not run straight. Square all-over stencils are especially particular in this respect; band stencils likewise. The curves used by draftsmen will be found very handy in making scrolls and curved lines. They are semi-transparent, so that the lines of the drawing can be seen through them.

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Locate the design on the stencil paper so as to have not less than a two-inch margin on all four sides. Then the color from the stencil brush will not smear the wall up around the outside of the stencil plate. Be sure and cut the whole stencil plate square with the base line on all four sides.

ENLARGING OR REDUCING SIZE

Use of the Pantagraph.—Any stencil in your possession can easily be made larger or smaller and at the same time

keep each line, figure, and detail the correct size in proportion to the rest of the stencil design. The tool called a pantagraph, shown in Plate 16, accomplishes this purpose well. Instructions for using it are sent with each tool, so time will be saved by omitting them from these pages. Pantagraphs are listed by a Chicago paint supply house as follows:

- No. 8864. Pantagraph, hardwood, simple construction, 17½ inches long; price.....\$0.50
- No. 1149. Pantagraph, hardwood, nickel-plated mountings, lead pencil and tracer interchangeable in tubular holder for reducing and enlarging..... 1.20
- No. 1148. Pantagraph, hardwood, nickel-plated mountings, interchangeable for reducing and enlarging in 25 ratios, in plain box; price 3.00
- No. 1144. Pantagraph, polished hardwood, fancy lined bars, 21-inch metal foot, interchangeable points for reducing and enlarging drawings, in 34 ratios, in plain box; price 4.00

Another Method.—Another way to enlarge or reduce a design is shown by Plate 16 also. Take the silhouette nursery stencil of a circus bear, by way of illustration.

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Assume that the picture you have is four inches high and that you need a stencil of it to be eight inches high.

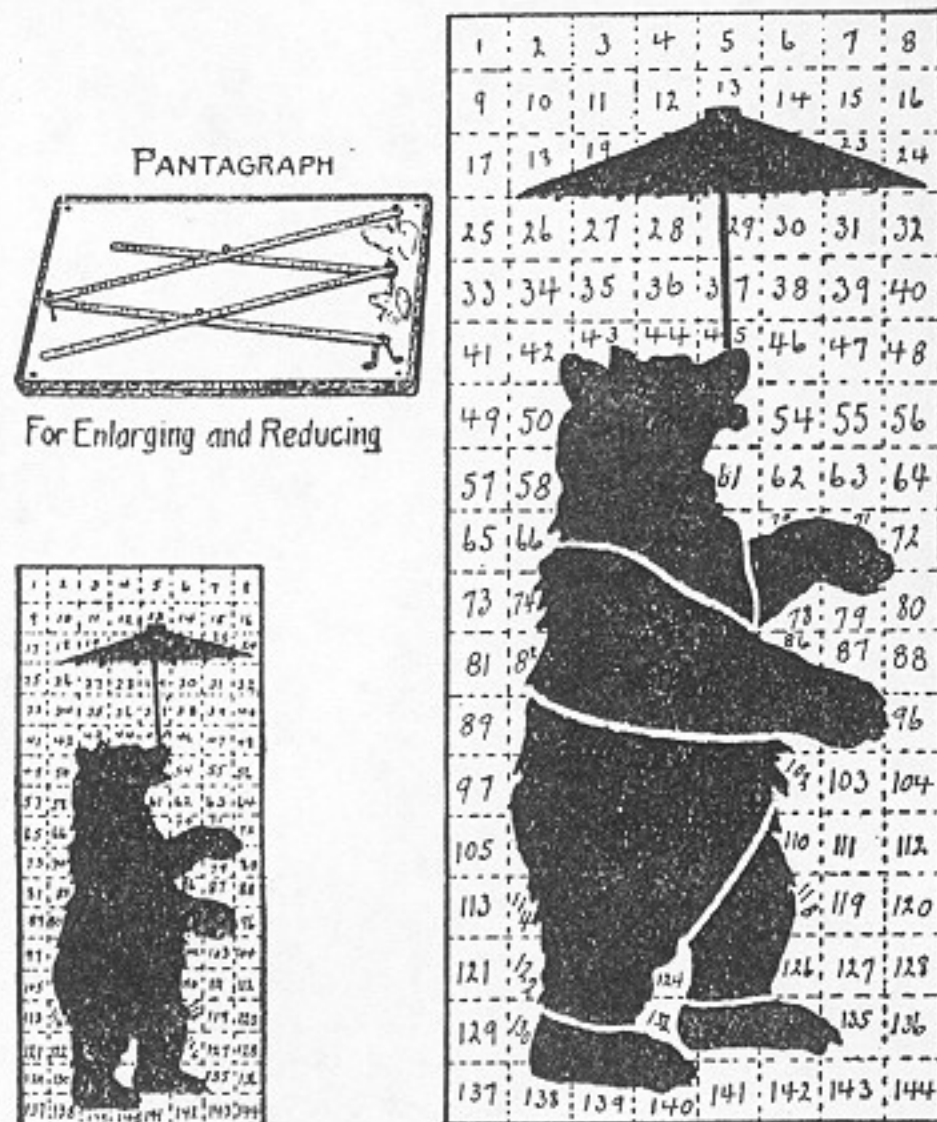


Plate 16.—Pantagraph, Used in Enlarging or Reducing Stencil Designs; Also the Square Method.

To begin the enlarging, draw lines across the picture you have crosswise and up and down to completely cover it with little squares, say of one-quarter inch size. Now

number the squares across the top from 1 down to 144 as indicated by the drawing.

Now it is desired that the enlarged stencil shall be twice as large as the picture, so the first step is to draw a rectangular panel twice as large as the one occupied by the picture you have, which is $2 \times 4\frac{1}{2}$ inches, so make the new drawing 4×9 inches and double the size of the squares. The squares on the picture are $\frac{1}{4}$ inch each way, so make the larger ones $\frac{1}{2}$ inch each way. Then number them in the same order as those on the small picture.

This done, the new picture must be drawn in free-hand, but the numbered squares show the location and curve of each line so well that the drawing amounts practically to copying. For instance, by looking at the picture, we see that the left-hand side of the parasol begins in the lower left-hand corner of square 18, runs up to the lower half of square 13, then down to the lower center of square 24, and back again in a slight semicircle to square 18, where the line began. We notice that the handle of the parasol runs through almost the center of squares 29, 37, and 45, not quite straight, but with a little slant. It is seen also that the bear's nose begins just a little below the center of square 45, his forehead in 44, one ear in 43, one in 42, and so on.

Now if you will begin to draw these portions of the design in on the larger squares, taking care to locate each line in the square bearing the same number as on the picture, and in the same relative position, you will have no difficulty in copying the design accurately to enlarge it.

It is well just to sketch in the whole design roughly first with a hard pencil, to locate the lines in the proper squares. Then go back, take one square at a time, and copy the direction and curve of the lines with care.

This done, go over the design as a whole, to connect

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up the sections of lines and smooth out the kinks. Next draw in the ties and cut the stencil. Obviously the drawing ought to be done on stencil paper.

This method should prove especially easy and handy for all who possess a little skill in drawing, and facility with a pencil. Anyone who is willing to make a few practice trials can readily use the method to advantage.

Use of the Scale.—The scale, shown on Plate 15, is a handy tool when laying out a drawing of some design which you want to make a smaller size, say one-half, one-fourth, or one-eighth the size of the original, and still keep the different members of the design in the same proportion to each other as in the large design to be copied. The architect draws his plan of a house, making it a certain size in proportion to the house when built. He lets $\frac{1}{8}$, $\frac{1}{16}$ or some other fraction of an inch represent a foot of the building itself. Then, when making his drawing, if the house is to be forty feet wide, he makes the drawing forty $\frac{1}{4}$ inches, or ten inches, wide.

A scale is used for obtaining the various measurements from a drawing. Scales are made in several forms, the most convenient being the flat with beveled edges and the triangular, like that shown in Plate 15. A scale is usually a little over 12 inches long, and is divided into sections for a distance of exactly 12 inches. The sections, or graduations, are arranged so that the drawing may be made in almost any proportion to actual size. The common divisions are multiples of two. Thus we make drawings full size, half size, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, etc. When a drawing is to be $\frac{1}{4}$ size, 3 inches (being one-fourth of a foot) equals 1 foot. Hence 3 inches on the scale is divided into 12 equal spaces and each space represents 1 inch.

The scale should never be used for ruling lines, or it will become marked up and be difficult to read. It is a measure, not a ruler.

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GUIDE MARKS AND KEYS

Band stencils, color stencils, and all that run continuously, as when below a picture mould, are most satisfactorily used when guide marks, or *register keys*, are placed at the left-hand edge of the stencil plate, and cut through. The marks are transferred to the wall along with the balance of the pattern. The marks usually consist of a part of the right-hand side of the design.

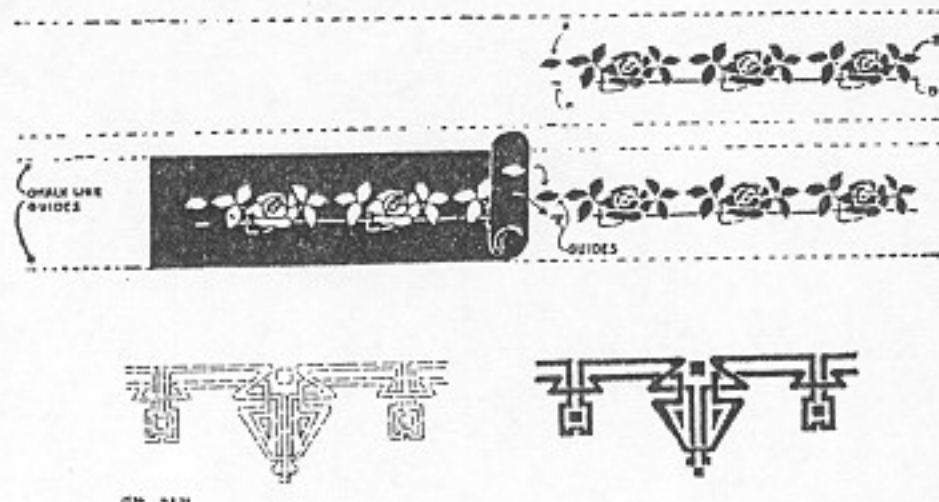


Plate 17.—Showing Guide Marks, or Register Keys, A, A, on Design B, B.

Plate 17 shows the guide marks A, A. They are parts of the right-hand figures of the design, marked B, B. To transfer the design from this stencil plate, begin on the right-hand side of one wall, in the corner. Set the stencil plate in the first position to follow a chalk line previously snapped on. Transfer the design, including the guide marks A, A, to the wall with the stencil brush in color in the ordinary manner. This done, remove the stencil and place in the next position to the left, for the second impression.

The portion of the design on the right-hand side of the stencil plate marked B, B, should be placed exactly over the guide marks on the wall, marked A, A. The stencil

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is now in the correct position for transferring the second setting of the design to the wall.

When the plate is made to register with each setting in this manner, it will run straight and each impression will match the one behind and ahead of it perfectly.

MAKING COLOR STENCILS

Color stencils for a two-color set are made in the following manner:

Draw or trace your design complete on a piece of tracing cloth or ordinary wrapping paper (not too thick to be traced through, using carbon paper). Place this sheet with the design on top of the paper from which the stencil is to be made. Insert a piece of carbon paper between the two and square up the corners of the three sheets. Lay them on the drawing-board and make them fast with a thumb tack, push pin, or needle in the upper right-hand and left-hand corners.

Now select the part or parts of the design which are to be transferred in color No. 1; say the parts marked *C* in Plate 8. Trace over these parts *only* with a hard pencil, so as to transfer them through the carbon paper to the stencil paper below. This done, pull all three sheets up, removing the thumb tacks or push pins.

To make the stencil for color No. 2, place another clean sheet of stencil paper on the board, the carbon next, and then the sheet having the complete design on it. Square up the sheets and again fasten down to the board with thumb tacks. See that the three sheets are *even* on all four sides, and that the two pieces of stencil paper from which the new color plates are to be made are exactly the same size as the sheet upon which the complete design was made. Trace the rest of the design, that is, all parts not marked *C*, which are to be transferred with the second color. The two plates are now complete, except for guides. Keep the original drawing ⁴⁷ as a pattern for future stencils should one plate or the other break while in use.

Registering.—Nothing has been said yet about the most important feature in making color stencils, namely, the registering, which simply means making the design match up accurately when transferred in two operations and from two different plates, to get the second color in the right place. This is accomplished by means of color guide marks, as shown by *G, G*, Plate 8.

See to it that the guide marks are transferred to the stencil plate made for the second color *only*. Cut them through the plate with the balance of the design, and do not transfer them to the wall with the second color. After transferring one color to the wall from the plate having the completed leaves on it, marked *C*, in Plate 8, you can set the second plate so that the guide marks will match with the ends of the leaves transferred to the wall by the first plate.

Two Kinds of Guide Marks.—Keep in mind that two kinds of guide marks are used. Those marked *G*, Plate 8, are for registering the second color plate on top of the stencil impression on the wall, which has been transferred by the first plate. Guide marks *A*, in Plates 17 and 8, are used to help set the first stencil in the second position on the wall, so that the design will match and join up closely, and run straight.

By having a plate for each color, made by repeating the above process as many times as need be, you can transfer a design in as many colors as you wish, without any

freehand filling in of colors, as with outline stencils. The outline stencil makes a more attractive job, however. The color plate method is most useful for some kinds of work, notably where the surface to be decorated is large, and when the expense must be kept to a minimum.

Two-Color Stenciling with One Plate.—Stenciling is often done in two colors, using an ordinary one-color ⁴⁸

stencil plate, and in one setting of the plate in each position. A separate stencil brush and pot of color is provided for each color. The brush must be fairly small. The stencil is set in place and held by needles or glass push pins, and the parts to be transferred in the second color are covered with the hand, a piece of tin, or cardboard, while the first color is being transferred. Then, without removing the stencil plate, the second color is transferred while the first is covered. Care is needed to avoid smearing a color in the wrong hole and to avoid moving the stencil, thus blotting the edges of one color or both.

When making a stencil for use in panels, such as are often part of a dining-room dado, and sometimes are found in friezes, it is best to make a stencil large enough to fill the whole panel, unless it be quite a large panel. The stencil plate may be held in place with glass push pins, and all color work and wiping can be done in one setting, so that the design will be complete when the stencil is removed.

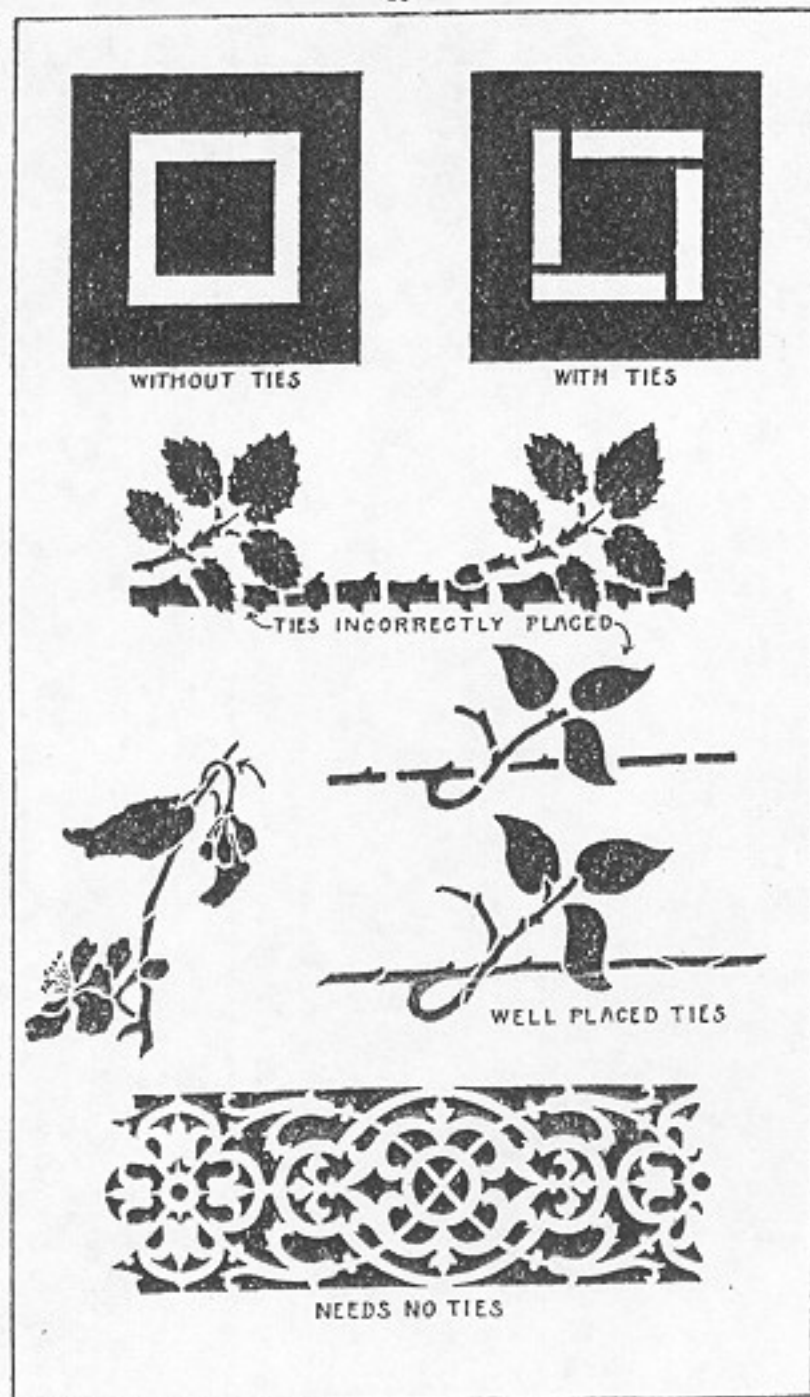
LOCATING TIES

How, when, and where to leave "ties," that is, little pieces of the stencil plate left between the cut-out details to hold the stencil together, is the beginner's great problem. The best aids to its solution are common sense and that precious "sense of the fitness of things." The thickness and toughness of the stencil plate will help to determine how many ties are required, and how wide they must be to hold the plate together. Make them wide enough to be strong and at the same time to look well in proportion to other members of the design.

That ties are necessary to the reproduction of most designs is obvious. Suppose you wish to stencil a hollow square pattern, as in Plate 18. When you cut through the paper plate to follow the lines on all four sides, the ⁵⁰

center section would fall out. The stencil plate would then transfer a solid, not a hollow, square impression. The center section must be held in place while transferring the impression, and to leave ties, or little pieces of paper connecting the center section with the balance of the plate like bridges, is the practical method. This illustrates the principle as it applies to all ties in stencils.

How to Place Ties.—Ties may be placed arbitrarily, making sure to have a certain number to each foot of stencil, or they may be placed only with the idea of making a strong stencil. But both methods are incorrect. Ties ought to be placed to make a stencil plate strong, but that can be accomplished while at the same time locating them so as to help the artistic appearance of the de-



sign. Make the ties help to improve the design, not interfere with its flowing lines and continuity. It is not necessary that stenciled ornaments be of a disconnected pattern, but many designs are more attractive with the blank spaces made by ties, if the ties are artistically placed to preserve the balance in design.

In placing the ties, parallel lines should always be strongly supported by direct ties, carefully placed. Ties which are introduced in a purely arbitrary fashion frequently have to be disguised by filling with color the blank spaces left by them in the design on the wall, to prevent their appearing too evident and obtrusive.

Ties come most frequently in long stems and lines. Sometimes it is possible to throw another stem, a leaf, or a tendril across at the weak point, and so get the desired strength without another tie. See Plate 18. This is the best way, as it adds interest at the same time. Of course, it should not be allowed to disturb the balance of the design. The tie can be made too evident in the design and may clearly intrude, completely breaking up the continuity.

Experience only will teach one the correct and incorrect placing of ties in stencil designs, but Plate 18 will give an understanding of the most common errors. The

plate also indicates the correct way to place ties. The background stencil at the bottom of the plate is of the class which requires no ties. The design is supported when cut out of paper by touching itself in many places.

Japanese Stencils.—A study of Japanese stencils is especially helpful as to the location of ties. They are indeed clever in this respect. Their ties are made to form the veins in the leaves and other natural parts of the design.

The people of Japan use stencils for many purposes besides house decoration, even on their clothes. One outstanding feature of their designs is that they excel in simplicity, never drawing in a complete motif, be it bird, insect, or flower. Enough is left to your imagination to excite interest. They suggest the outline merely. Yet their ideas in stencil are clear; they "get over," and are not vague. The colors used are nearly always transparent dyes and stains, with only an occasional use of opaque color to emphasize a detail.

The Japanese decorator does not often use ties in his stencils, even though they are of a most delicate and complicated design. He handles the stencil in such a way as to gain the support given our stencils by ties. The Japanese pattern is drawn on a thin sheet of strong rice paper, which is then laid flat on top of a second sheet of the same paper. In cutting, the knife is made to go through both sheets, thus cutting two stencils at once which are exactly the same; they register. Next one sheet is coated with glue, and across all openings which need the support of ties, pieces of silk thread are laid arbitrarily as to design. The second stencil plate, the duplicate, is then laid on top of the glued-on threads, and a plate of double thickness results. It is strong enough

for all practical purposes. The threads do not leave blank spaces on the wall, as do paper ties, because the bristles of the stencil brush work the color under them. There seems to be no reason why this form of construction should not be used by American decorators for all the designs for which it is superior. It has in fact been used to some extent.

Complicated Designs.—The making of stencils to transfer complicated designs, those having many small details to be cut out, is usually handled most practically by making two or more plates in the same manner as when a stencil is to be transferred in two or more colors. That is, a plate is made for each color to be used, and each plate has cut into it only the part of the design to be transferred in that color.

Some designs from which stencils are cut make one-plate stencils which are frail indeed, and they do not last long. The brush tears the small ties after a few settings in decorating a wall.

But when two plates are made to transfer the same design in two settings, a stronger stencil results. Of course, it requires a little more time to transfer the impression from two plates than from one. It can be transferred in two colors, however, just as easily as in one.

In using two plates for a design, the details, such as leaves, stems, and flowers, for instance, can be made to

connect more closely, or to join solidly if that is to be desired.

Metal Stencil Ties.—On metal stencils, except sheet lead, the ties are usually pieces of fine steel wire, soldered in place arbitrarily to make a strong stencil. The brush puts color on under the wire ties, and so they do not show. Metal stencils require few ties.

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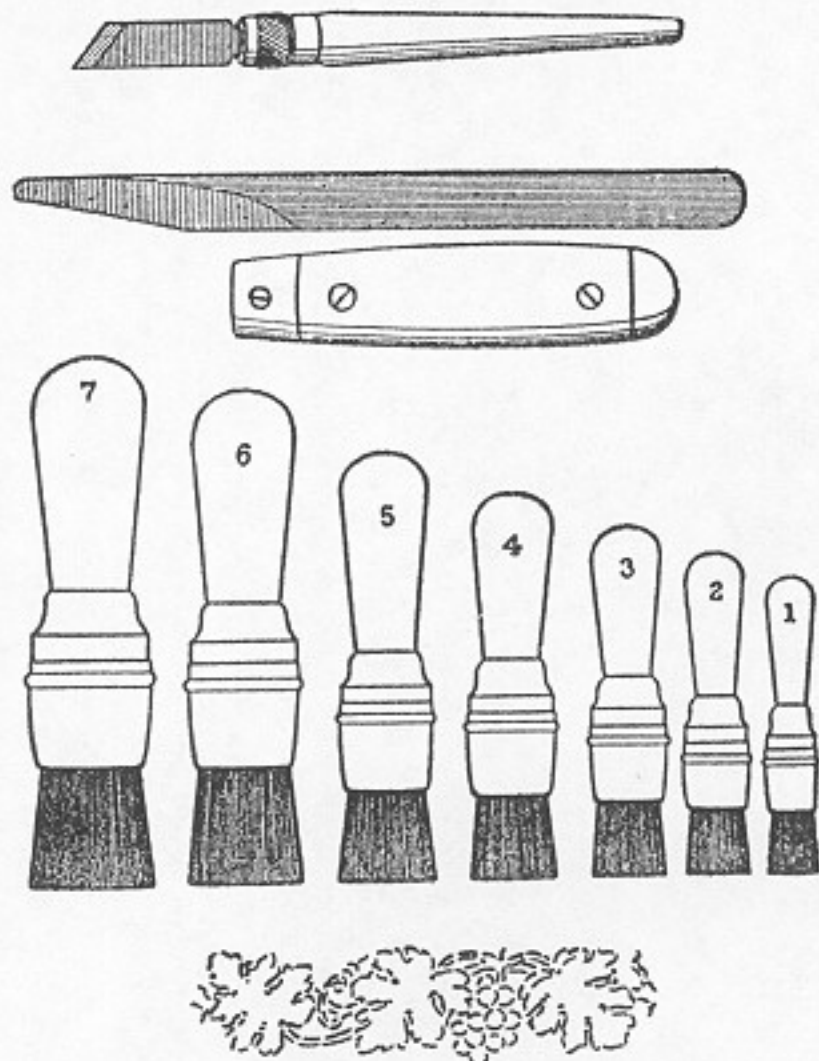


Plate 19.—Brushes and Tools Used in Stencil Work, also a Grapevine Design.

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CUTTING THE STENCIL

Paper Stencil.—The design to be cut is drawn on stencil paper. Then the first essential is a knife with a good piece of steel for a blade. Plate 19 shows the regular stencil knife sold by the supply houses. Sometimes a good pocket-knife is better. Any knife which is not too hard on the fingers when cutting, and which has a point that can be kept sharp, will do. An oilstone must be nearby, so that the knife can be sharpened at least once for each stencil cut. If not sharp, it will cut a stencil which will produce ragged, round edges.

A large piece of plate glass on a table is the best surface upon which to place the stencil while cutting. A small piece of ordinary window glass will do, laid on a flat table top. Just see that it is quite a little larger than the stencil to be cut. A piece of sheet zinc will serve for a cutting surface also.

If you wish, the paper from which the stencil is to be cut may be dampened slightly by laying a wet cloth over it. Then paste the four corners down to the glass. When the paper becomes dry it will shrink tightly and perfectly flat.

Arrange to move the stencil so that you can always

pull the knife to you in cutting, rather than push it away from you; although it is true that the Japanese cutter pushes the knife away from him.

Cut with the sharp point of the knife and keep it sharp. When cutting a straight line, lay down a ruler to follow.

Take great care to avoid cutting through some of the ties. If you do cut through one, glue a strip of cloth or paper over it firmly, to hold it in place.

For cutting holes in a stencil, one quarter to two inches in diameter, steel leather belt punches are used for accuracy and speed.

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Hold the knife not too straight up and down. Slant it toward you a little and it will turn the curves more easily and remain sharp longer.

Metal Stencils.—Metal stencils are placed on a lead block for cutting with chisels and punches. Files, drills, and hack saws are also used in the cutting.

RELIEF STENCILS

The Greek civilization highly developed in art 2500 years ago, loved and developed the beauty of form rather than color. Among the oldest designs known today are the Greek frets, or key designs, shown in Nos. 1804, 1212, 1211, 1208, Plate 1, and they were cut in relief in beautiful marble and stone, usually without color.

This form of ornament can be produced with stencils. It possesses great merit from the artistic standpoint and deserves a much wider use. It consists, as the name implies, of raised designs set in relief on a flat or curved surface. The design is cast or moulded on the surface by filling a deep-cut, thick stencil plate with a plaster composition.

Relief stenciled designs may be colored with transparent colors, such as the umbers and siennas, or left in the white. Shellac the surfaces to stop suction before coloring. The color may be partly wiped off for a pleasing effect.

Materials Used.—Relief stencils are drawn the same as other kinds, but not on paper. The stencil plates are cut from some material which is one-eighth inch, one-quarter inch, or three-eighths inch thick. Soft woods, such as basswood and clear white pine, are suitable. Good quality cork linoleum, made for floors, is excellent material because it is easy to cut, is flexible, and lies close to the wall.

Cutting.—The stencil when cut ought to be varnished or shellacked. The cutting is done with the scroll or fret

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saw used by carpenters and cabinetmakers. A hand fret saw will do. Chisels, drills, and sharp knives are also needed. It is well to cut the design so as to taper slightly toward the back of the stencil. Then, when removing the plate, after filling in the composition material to form the pattern, it will come off easily without breaking the edges. The inside surfaces of the design must naturally be smooth and without suction.

Placing on the Wall.—The relief plaster design is best cast on to the bare plaster wall. Sandpaper thoroughly

any paint on the surface to the bare plaster, and wet it before casting the new plaster design. The stencil plate must be held firmly and steadily in place for a few minutes with each setting, to permit the plaster to set before removing it. As to location, point of beginning, etc., what has been said here about handling ordinary stencils applies to relief stencils.

Composition.—The plaster composition to use for this work can be purchased from decorators' supply houses in the dry form, ready to mix with water. You can make a suitable composition from plaster of paris chiefly, with a little whiting added. Dissolve just enough first-class glue in water to make a strong size. Mix the plaster of paris and whiting to a stiff putty with this size. Force this putty well into the stencil plate with a putty knife, trowel, or spatula, holding the stencil tightly against the surface at the same time. Smooth off the face evenly.

Even without the beautiful color effects which are to be obtained on relief designs by transparent colors, wiping out high lights, shading, etc., this work is wonderfully attractive when confined to simple patterns of perfect classic design. The depth of the design causes it to cast a shadow and to show perspective, which we do not have with flat ornaments on flat surfaces.

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CHAPTER IV

COLORS AND COLOR HARMONY

So large a subject as that of color can hardly be covered satisfactorily in the limited space of a single chapter, yet there are some essential principles of color use, affecting the artistic employment of stencils, which ought to be presented, however briefly it must be done.

The coloring of stencils, obviously, must be governed in a large measure by the wall and ceiling colors of a room, by the trim and the furnishings. Yet this is not the place for a full consideration of these factors.

Cultivation of Color Sense.—We hear it said that but few people have a well developed eye for color selection, mixing, and matching. There is mighty little truth in such statements. To be sure, some people are color blind, while others have an eye for color and a color sense much more highly developed than the average person or painter, and so are able to distinguish and appreciate exceedingly delicate variations and harmonies of color.

Color management is gained through both sight and feeling. The study and application of well-known color rules will enable the average painter to get on well. The mastery of color harmony comes also through constant association with and study of the beautiful things produced by man, and especially the beauties of nature. Diligent observations and careful deductions from what you see in the coloring of the birds, the flowers, and butterflies will soon quicken your color sense and make it quite beyond a possibility for you to produce color schemes which do not have the harmony and feeling which please us.

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Obviously, trials and practice in mixing and matching colors are as essential as to study the fine coloring effects

produced by nature and by man. Without these individual tests, progress is not made. But get into the habit of enjoying the beautiful in color, proportion, and form. Read the history of art, and it will help your work.

Color Management in Stencils.—It may seem ill considered to try to give specific, definite ideas about colors, color schemes, and color use without showing actual colors in print. Color names are as a rule so inadequate and non-descriptive. But an attempt will be made to state the most important facts concerning color management as it relates to stencils—the points to be kept in mind and used. When specific colors are mentioned, they will be described by their ingredients or formulæ rather than by names alone.

Concerning the finished effect of stencil decoration on walls, keep ever before you the requirements of artistic and good decoration.

Stencil ornament must be in harmony with the general decorations and furnishings of a room, both in color and in form.

It must be restful to the eye and not too bold or too prominent to enable a person to relax and rest.

Walls, whether ornamented with stencils or not, ought to form a good background for the display of pictures and the right color setting for furniture, rugs, and drapery. When walls are painted or papered too strongly in colors or in the figure of stencil or wall paper, they attract undue notice, diverting attention from the effect of the room as a whole. It is just as poor taste to have spectacular furniture or overcolored rugs as to have walls out of harmony, but the painter exercises no control over these other details and he is responsible for the effect of the wall treatment.

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Delicate Colors Preferred.—For interior decoration stencil colors should *always* be soft and delicate, with this exception: Some stencil designs contain small centers or areas which deserve strong, bright coloring in order to set off the whole design properly. These are called *jewel points*, and require bright, strong treatment in color. The area thus colored should seldom be more than two or four inches in diameter, usually less.

What are soft, delicate colors? And what are strong, harsh colors? Light colors made by tinting white with but a small quantity of any color are soft in tone, but as a rule they are made on a white-lead base and are, therefore, opaque. So they are not as useful for stencils as semi-transparent colors, such as the umbers, siennas, greens, and blues.

How then are you to secure a light, soft yellow, for instance? Chrome yellow alone is harsh and too strong. It is also opaque. Mix it with white lead to make a nice soft yellow and you have the color, but not the transparent effect preferred for stencil colorings. Yellow lake is transparent and will give you nice, light, soft tints, but it fades quickly.

Here is the way to produce the soft, durable yellow tint: Raw sienna in the can is brown, and on dark

surfaces it is still brown; but spread this transparent sienna over a white or light colored ground—spread it *thin*, and a clear soft yellow tint will result.

This principle holds with all semi-transparent colors. A cobalt blue, used as it comes from the can, is far too strong and harsh to be used for even fairly large areas of wall surfaces. But mix it thin and spread over a white, light gray or ivory ground coat, and you have a pure light blue tone which is attractive indeed.

The term "harsh colors" is best used as describing crude colors, such as Prussian blue, which has a green-
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ish cast. A little black, red, or yellow added to it will modify and soften the color.

It is a general rule that for many purposes a much more pleasing effect is produced by mixing two or more colors together than by using one clear color. You might, for instance, use a brown (burnt umber) for vines and stems of flower patterns; but add a little raw umber and a touch of red, and a more pleasing color results.

This principle is especially noticeable when mixing opaque colors by tinting a white-lead base. Mix a brown from white and burnt umber alone and it is lifeless, but add a touch of chrome yellow, a little raw umber, and red, and an exceedingly pleasing brown results. You cannot see the yellow nor the red in the brown, but it is there—you can feel its influence.

All tints and shades are more pleasing to the eye when two, three, or four colors are used in their mixing than when but one or two are used. The complicated formulæ, in other words, produce more attractive colors than simple formulæ.

POINTS TO REMEMBER ABOUT COLORS

When equally light or equally dark colors are mixed together, the resulting color will be a little darker than either of the two.

Blacks, ochre, chrome yellow, and white lead are not semi-transparent, but opaque. They hide the surface. They are not glaze colors.

The lake colors are more transparent even than the umbers, siennas, cobalt blue, Prussian blue, ultramarine blue, chrome green, vermilions, Indian red, Venetian red, Vandyke brown, verdigris green, and some others less commonly used. Those enumerated are the most important and permanent of the glaze colors and are semi-transparent.
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Opaque colors (those which cover solidly) appear flat and uninteresting when used for stencil purposes. Semi-transparent colors—umbers, siennas, chrome green, and yellow—give an appearance of depth which is good to look at. A transparent color laid on thin as a glaze over opaque colors or bronze metals is especially attractive.

When two or more colors of a stencil are a little out of harmony, a thin glaze coat of some semi-transparent color, spread over both colors, will often unite them and improve the harmony wonderfully.

Don't color natural forms inconsistently. It shows

poor taste to tint the natural outlines of roses with blue. Nor should daisies be colored purple—they don't grow that way. On the other hand, conventional forms of the rose, the daisy, and other natural motifs may well be colored with any light tints which will harmonize with the rest of the color scheme.

Avoid using too many different colors. It is better by far to use a few shades or tints of one color.

COLOR HARMONY

Color harmony is produced in two principal ways—by analogy and by contrast.

Harmony by *analogy* results from using related colors, those which have something in common with each other. When you mix a light gray, by adding a little black and a touch of raw umber, for a ceiling color, and then produce a side wall color in the same way, but using more black and more umber, you harmonize by analogy. The two colors are related. They would still harmonize, by the same principle, if the lighter color had also some red in it, while the darker had yellow in its make-up. Both colors would still possess the black, white, and umber in common. Color harmony by analogy is by far the safest and easiest way to be certain about the outcome of combinations.
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To secure harmony by *contrast* means the use of two or more unlike colors which appear well together and complement each other. Red and green, purple and yellow, orange and blue, all harmonize by contrast.

Lack of harmony between strong, pure colors is quickly detected by the average person. With medium and light colors it is not so easy to detect it. When it comes to very light colors in the transparent class, it may almost be said that all colors harmonize with each other.

The inexperienced decorator usually possesses a tendency to use too many colors, too strong colors, and to repeat a design too many times. Don't do it! One reaches the point of satisfaction with colors and designs, as with everything else. The simple, well-proportioned, tastefully colored decorations have the most charm. And remember, too, that blank space is needed to balance the ornament and give a pleasing appearance to the wall as a whole.

VARIATIONS OF COLOR

A *tone* refers to the comparative brightness of a color. Colors may be lighter or darker in tone according to the quantity of light they reflect.

A *tint* is produced by adding white to any color. Colors are of different tints in proportion to the amount of white in them.

A *hue* is the changed effect produced by adding one color to another. Thus we may add a reddish hue to a brown, a greenish hue to blue, etc.

A *shade* is a degree of difference in tone. When two colors have the same hue (quality of color) and tint, but are different in tone, the dull one is a shade of the other.

DECORATORS' OIL COLORS

Many of the colors used for stenciling, striping, and

glaze work are those usually purchased for tinting white lead. The umbers and siennas especially are suitable for stencil decorating, provided they are of first-class quality. For particularly nice jobs it is advisable to buy the special decorators' colors in tubes or cans, as they are clear in tone, brighter, and more transparent. They are ground very fine in linseed oil, and put up in one-pound friction-top cans, which may be easily opened and closed; also in large tubes, $1\frac{1}{4} \times 6$ inches. Substantially the same colors can be secured ground in japan or turpentine, also in water (called "distemper").

The principal advantages to be gained by using these special decorators' colors are that such colors are stronger in tinting strength, clearer in tone, and more transparent than ordinary house-paint tinting colors. For ordinarily good work, however, colors of the latter class are completely satisfactory. They are not muddy, nor short in coloring strength, when they come from reputable manufacturers.

Following is a list of special decorators' colors, "ground in linseed oil," handled by one supply house.

Blacks.—Ivory black, lamp black.

Blues.—Antwerp, cobalt, Prussian blue, ultramarine.

Browns.—Burnt sienna, raw sienna, burnt umber, raw umber, Vandyke brown.

Greens.—Chrome green, light; chrome green, medium; chrome green, dark; sap green, Zinnobar green, ultramarine green.

Lakes.—Alizarin lake, blue lake, carmine lake, crimson lake, geranium lake, green lake, light; green lake, dark; mauve lake, olive lake, orange lake, rose lake, scarlet lake, yellow lake.

Reds.—Decorators' red, Indian red, permanent red, rose pink, Turkey red, Tuscan red, Venetian red.

Vermilions.—American vermilion, English vermilion.

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Yellows.—Chrome yellow, lemon; chrome yellow, light; chrome yellow, medium; chrome yellow, orange; Dutch pink, golden ochre, yellow ochre.

White.—Flake white.

LIGHT AND COLORS

Electric and gas lights affect color schemes considerably. Pure yellow which is free from a greenish or reddish tinge appears under artificial light to be almost white. Pure blue seems almost black. Scarlet appears normal but brighter. Bright pure bluish green appears normal but a little dull.

Other changes noticeable under the influence of electric or gas lights are:

Azure blue.....	appears gray and dull
Cadet blue.....	" soft and dull
Peacock blue....	" soft and dull
Old blue.....	" soft and dull
Robin's egg blue.	" gray and dull
Brown	" softer
Buff	" to be little changed
Gray	" softer
Green	" softer
Lavender	" adversely affected

Maroon	" softer
Pink	" adversely affected
Purple	" adversely affected
Reds	" to be little changed
Rose	" adversely affected
Salmon	" adversely affected
Terra cotta.....	" softer
Violet	" to be little changed
Yellow	" softer

PERMANENCE OF COLORS

As is pretty generally known, some commonly used colors are more permanent than others and so are serviceable for a much longer period without fading or changing from the influence of strong light. Following is a classification of many of the most useful colors, with respect to their permanence:

Permanent	Fairly Permanent	Fugitive and Likely to Fade
WHITE— Flake white White lead Barium white	Zinc white	
RED— Indian red Venetian red Red ochre Burnt sienna Tuscan red	Vermilion Madder red Turkey red Rose pink Orange chrome	Red lead Crimson lake Scarlet lake
YELLOW— Raw sienna Yellow ochre Golden ochre	Aureolin Barium yellow Cadmium Chrome yellow Indian yellow Naples yellow Dutch pink	Yellow lake Zinc chromate
GREEN— Chrome green Cobalt green Green ultramarine	Emerald green Madder green Malachite Terre verte	Green lake Sap green Verdigris
BLUE— Cobalt Ceruleum Smalt Ultramarine (except with white lead)	Prussian blue Antwerp blue	Indigo
BROWN— Burnt umber Raw umber	Vandyke brown (mineral)	Vandyke brown (organic)
BLACK— Lamp black Charcoal black Ivory black Graphite black		Bitumen black

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COLOR SCHEMES

Naturally, the colors to be used for stencils are determined by other colors used in the room, and are governed by the character of the room, the light, and the color preferences of those who occupy the rooms.

A few color schemes in general will, nevertheless, be helpful as a means of stimulating thought and of suggesting others. When it is said that the color schemes which follow are interesting, in good taste, and suitable, it must be understood that this is true principally when

the wood trim and furnishings are in harmony with the colors suggested.

same holds true in describing, mixing and using most colors.

You will note that the blues, browns, yellows, and other colors are also specified as dull greens, pale yellows, soft grays, etc. That is to distinguish them from the full, clear colors, which are usually much too harsh to use until toned down by the addition of some other colors. A blue, especially Prussian, is far more attractive for interior decoration after you have added a touch of black and a bit of red, to make what is called an "old blue." The soft, dull appearance of pastel colors is the effect you want to approximate in practically all colors used on large wall spaces and on stencils.

In decorating the average home, no better color plan can be followed than to use one general tone throughout the several rooms. Of course the one color may well be made lighter or darker for each different room. The warm grays, dull, light gray-greens, and tans are excellent for this purpose, forming a good background for pictures and other furnishings.

COLOR FORMULÆ

In connection with the color formulæ in the pages that follow, two points must be kept constantly in mind:

First, there are no standard names for colors. Perhaps it ought to be stated the other way,—there are no standard colors for color names.

Lay out a certain medium shade of warm yellow, and ask several people what color it is. One will say buff, another fawn, others goldenrod, russet, pumpkin color.

and so on. So it is with most colors. Perhaps some day our government will establish color standards, as it has already declared how much weight constitutes a pound, how much of any liquid equals a gallon, etc.

The colors produced by the formulæ given here are considered by the average decorator to be correct for the names attached to them. You must, however, mix any one of them lighter, darker, or a little different if necessary to produce what your customer thinks is a better color for the name given.

The second point to keep in mind is that the tinting strength of different brands of colors varies considerably. The writer has used seven pounds of a cheap yellow ochre to tint a batch of white lead to the same shade of cream as was produced by one pound of first-class French ochre with the same amount of lead.

Some brands of tinting colors are greatly extended by inert pigments, because some people want cheap colors. The high class, strong colors are cheapest in the end, and far better and clearer tints are produced. In mixing the colors to test these formulæ, first-class colors of a standard advertised brand were used. All the formulæ were carefully verified. The list is quite extensive, affording a wide range of color for selection and is arranged in alphabetical order, as follows:

Amber.—Burnt umber, 3 parts; middle chrome, 3 parts; orange chrome, 8 parts.

Argent (Gray).—Black, 9 parts; white lead, 16 parts;

For These Wall
Colors

Use These Stencil Colors

Cream
Buff
Fawn

Soft green, gray-green, sage, orange, brown, dull red, green, light tan, white, ivory.

Light cobalt blue
Delft blue
Dull gray-blue

Dark blue, orange, yellow, browns, sage, gray-green, light soft pink, black and light orange, white.

Gray-green
Olive
Sage

Brown, orange, ivory, cream, rose, light yellow, white.

Yellow

Purple, light blue, orange, russet, white, buff.

Pearl gray

Ivory white, light gray, olive, sage green, light blue, rose, white, orange.

Tan

Cream, brown, white, dull green, ivory.

Umber grays

Dull green, light gray, rose, orange,
white, ivory.

Stencils always look well on a wall when transferred in the ceiling color, and *vice-versa*. Or a color midway between the wall and ceiling colors (mixed on the same formula), but a few degrees darker or lighter, may be used.

Ivory white, pure white, and light gray may be used for stenciling on practically any ground color.

Bedrooms			
Walls	Ceiling	Stencil	Trim
Light gray	Same	Rose and white	Med. light gray
Soft light yellow	Yellowish white	Light cobalt blue	Ivory enamel
Light olive	Ivory	Gray, rose and white	Natural wood
Greenish gray	Light gray	Dark green and orange	White
Living Room			
Walls	Ceiling	Stencil	Trim
Light tan	Cream	Brown, white, yellow	Walnut brown
Warm gray	Light gray	Gray-green, rose	Mahogany
Pearl gray	Ivory	Soft red and green	Olive green
Dull pea green	Gray white	Olive, sage green	Natural or brown
Dining Room			
Walls	Ceiling	Stencil	Trim
Medium gray	Light gray	Delft blue and orange	English brown
Grayish blue			Oak
Soft tan	Cream	Brown, red, white	Warm gray
Light yellow	Ivory white	Sage green, purple	Ivory, natural or brown
French gray	Light gray	Rose, dull green, white	Med. dark gray

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Indefinite Color Names.—When a color is mentioned by name, keep in mind always that it is only a general term until more definitely described. The name "green" is indefinite indeed until it is described either as a blue-green, meaning that it has a bluish cast; a gray-green, with a dull grayish cast; an olive or yellow green. The

red, 1 part; trace of orange.

Ash.—White lead, 50 parts; raw umber, 5 parts; yellow ochre, 1 part.

Bay.—Black, 3 parts; Venetian red, 3 parts; slightly shade with orange chrome.

Black (Jet).—Ivory black, 10 parts; umber, 1 part; Prussian blue, 1 part.

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Black (Olive).—Vine-black, 20 parts; yellow ochre, 1 part.

Black (Purple).—Lampblack, 5 parts; rose pink, 1 part.

Blue (Antwerp).—Antwerp blue. Or compound with bright green, 1 part; ultramarine, 2 parts; trace of zinc white.

Blue (Azure).—Azure blue. Or compound with: Ultramarine blue, 1 part; zinc white, 40 parts.

Blue-black.—Ivory-black, 40 parts; Prussian blue, 3 parts.

Blue (Bronze).—Black, 3 parts; Prussian blue, 1 part.

Blue (Dark).—White lead, 1 part; chrome green, 2 parts; Prussian blue, 7 parts.

Blue (Delft).—Tint white lead with cobalt blue and a touch of lamp black.

Blue (Deep).—Prussian or ultramarine blue.

Blue (Gobelin).—Ivory-black, 4 parts; white lead, 2 parts; chrome green, 1 part; Prussian blue, 3 parts.

Blue (Granite).—Black, 2 parts; white, 6 parts; ultramarine blue, 1 part.

Blue (Grayish).—White lead, 20 parts; Prussian blue, 2 parts; ivory-black, 1 part.

Blue (Indigo).—Indigo, or compound with: Black, 9 parts; Prussian blue, 4 parts.

Blue (Light Prussian).—White lead with a touch of Prussian blue.

Blue (Light Gray).—White lead with a touch of lamp-black and of raw umber.

Blue (Marine).—Ultramarine blue, 1 part; ivory-black, 9 parts.

Blue (Methyl).—Green, 1 part; blue, 12 parts; trace of red.

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Blue (Misty).—White lead, 50 parts; ultramarine, 10 parts; burnt umber, 1 part.

Blue (Mountain).—Mountain blue. Or compound with: Ivory-black, 1 part; cobalt blue, 3 parts; rose madder, 2 parts; white lead, 4 parts.

Blue (Old).—Mix from Prussian blue and a touch of lampblack or ivory black.

Blue (Opaque).—Zinc white, 1 part; French ultramarine, 1 part.

Blue (Oriental).—White lead, 100 parts; Prussian blue, 9 parts; lemon chrome, 1 part.

Blue (Pale).—White lead, 30 parts; Brunswick blue, 1 part.

Blue (Pure).—Zinc white, 20 parts; English ultra-

marine, or cobalt blue, 2 parts.

Blue (Royal).—White lead, 1 part; ultramarine, 15 parts.

Blue (Sapphire).—Zinc white, 4 parts; Chinese blue, 1 part.

Blue (Sea).—White lead, 16 parts; ultramarine, 3 parts; raw sienna, 2 parts.

Blue (Pale Sky).—White lead, tinted with cobalt blue.

Blue (Sky).—White lead, 300 parts; cobalt blue, 1 part; Prussian blue, 1 part.

Blue (Turquoise).—White lead, 20 parts; ultramarine, 2 parts; light green, 1 part.

Brass Yellow.—White lead, 40 parts; light chrome yellow, 12 parts; raw umber, 1 part; burnt umber, 1 part.

Brick.—Venetian red, 2 parts; white lead, 1 part.

Bronze.—Black, 14 parts; yellow, 1 part; green, 2 parts.

Bronze (Asiatic).—Medium chrome yellow, 1 part; raw umber, 2 parts; very little white lead.

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Bronze Green.—Middle chrome, 2 parts; raw umber, 5 parts; burnt sienna, 1 part; black, 1 part.

Bronze Yellow.—White lead, 10 parts; lemon chrome, 4 parts; raw umber, 5 parts.

Brown (Alderney).—Yellow, 3 parts; black, 14 parts; white lead, 1 part; orange, 2 parts.

Brown (Amber).—Burnt umber, 9 parts; middle chrome, 5 parts; Venetian red, 3 parts.

Brown (Chestnut).—Medium chrome yellow, 4 parts; Venetian red, 2 parts.

Brown (Coach).—Indian red, 5 parts; ivory-black, 2 parts.

Brown (Cocoanut).—Burnt umber, 4 parts; yellow ochre, 1 part; white lead, 1 part.

Brown (Coffee).—Burnt umber, 9 parts; yellow ochre, 4 parts; Venetian red, 1 part.

Brown (Foliage).—Vandyke brown, 2 parts; burnt sienna, 1 part.

Brown (Golden).—White lead, 20 parts; yellow ochre, 3 parts; burnt sienna, 1 part.

Brown (Italian).—Vandyke brown, 4 parts; raw sienna, 1 part.

Brown (Leather).—Yellow ochre, 4 parts; Venetian red, 3 parts; white lead, 2 parts; blue-black, 1 part.

Brown (Olive).—Burnt umber, 3 parts; lemon chrome yellow, 1 part.

Brown (Orange).—Burnt sienna, 5 parts; orange chrome, 4 parts.

Brown (Pale).—White lead, 4 parts; burnt umber, 1 part.

Brown (Purple).—Indian red, 8 parts; burnt umber, 1 part; black, 1 part.

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Brown (Seal).—Burnt umber, 4 parts; golden ochre, 1 part.

Brown (Snuff).—White lead, 9 parts; orange chrome, 1 part; burnt umber, 2 parts.

Brown (Stone).—Burnt umber, 10 parts; golden ochre, 1 part; burnt sienna, 2 parts.

Brown (Thrush).—Yellow ochre, 1 part; burnt umber, 3 parts; white lead, 12 parts.

Brown (Walnut).—Burnt umber, 5 parts; raw sienna, 1 part.

Buff.—White lead, 100 parts; yellow ochre, 7 parts; middle chrome, 1 part.

Buttercup Yellow.—Middle chrome.

Canary.—White lead, 10 parts; lemon chrome, 1 part.

Chamois Yellow.—White, 4 parts; yellow ochre, 5 parts; green, 1 part.

Chamoline (Yellow).—Raw sienna, 3 parts; lemon yellow, 1 part; white lead, 5 parts.

Chocolate.—Burnt sienna, 5 parts; carmine, 1 part.

Cinnamon.—Golden ochre, 1 part; burnt sienna, 2 parts; white lead, 6 parts.

Citron (Yellow).—Raw umber, 2 parts; lemon chrome 5 parts.

Claret.—Carmine, 2 parts; ultramarine blue, 1 part.

Copper.—White lead, 100 parts; middle chrome, 19 parts; Venetian red, umber, and green, 3 parts each.

Cream.—White lead, 100 parts; raw sienna, 3 parts.

Cream.—White lead, 100 parts; Italian ochre, 3 parts.

Crimson (Amaranthine).—Vermilionette, 3 parts, Prussian blue, 1 part.

Drab.—Burnt umber, 1 part; white lead, 10 parts.

Drab (Deep).—White lead, 20 parts; burnt umber, 14 parts; ochre, 2 parts.

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Drab (Light).—White lead, 50 parts; burnt umber, 12 parts; ochre, 1 part.

Drab (Medium).—White lead, 100 lbs.; raw umber, 4 lbs.; French ochre, enough to tone to tint wanted.

Drab (Warm).—White lead, 100 lbs.; raw umber, 1½ lbs.; French ochre, 2 to 3 lbs.

Ecrú.—Brunswick green, 1 part; medium chrome yellow, 3 parts; white lead, 8 parts; black, 3 parts.

Fawn.—White lead, 60 parts; burnt umber, 5 parts; yellow ochre, 3 parts.

Fawn (Deep).—White lead, 10 parts; burnt umber, 4 parts; ochre, 1 part.

Flesh.—White lead, 50 parts; yellow ochre, 2 parts; burnt sienna, 1 part.

Gold.—Color white lead with yellow ochre, raw sienna, or chrome yellow, 5 parts; vermilion, 1 part.

Granite (Blue).—Black, 2 parts; white, 6 parts; ultramarine blue, 1 part.

Green (Aloes).—Black, 6 parts; white lead, 3 parts; chrome yellow, 1 part; Brunswick green, 3 parts.

Green (Apple).—Medium chrome green, 1 part; white lead, 30 parts.

Green (Autumn).—Emerald green, 2 parts; black, 7 parts; chrome yellow, 1 part.

Green (Blue).—Deep green, 7 parts; Prussian blue, 1 part.

Green (Bottle).—Light green, 6 parts; lampblack, 1 part.

Green (Chartreuse).—Chrome yellow, 4 parts; chrome green, 5 parts; tint with white.

Green (Chrome).—Chrome green. Or compound with Prussian blue, 1 part; lemon chrome yellow, 8 parts.

Green (Citron).—White lead, 40 parts; middle chrome, 3 parts; ivory-black, 1 part.

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Green (Emerald).—Emerald green. Or compound with white lead, 8 parts; medium chrome green, 1 part.

Green (Foliage).—Blue-black, 1 part; lemon chrome, 4 parts.

Green (Gray).—Terre verte, 10 parts; raw umber, 1 part; white lead, 1 part.

Green (Invisible).—Black, 9 parts; bright green, 1 part.

Green (Light Olive).—Middle chrome, 3 parts; black, 2 parts; burnt sienna, 1 part; trace of white lead.

Green (Marine).—Black, 4 parts; middle chrome green, 1 part.

Green (Middle Chrome).—Lemon chrome, 1 part; middle chrome, 1 part; Prussian blue, 2 parts.

Green (Mignonette).—Chrome green, 3 parts; black, 15 parts; Prussian blue, 1 part; chrome yellow, 1 part.

Green (Moss).—Medium chrome green, 30 lbs.; raw umber, 12½ lbs.; medium chrome yellow, 6 lbs.

Green (Moss Rose).—Brunswick green, 1 part; yellow, 4 parts; white lead, 3 parts.

Green (Muscovite).—Prussian blue, 6 parts; chrome green, 13 parts; orange chrome, 3 parts; white lead, 8 parts; black, 20 parts.

Green (Myrtle).—White lead, 20 parts; middle chrome, 7 parts; ivory-black, 1 part.

Green (Nile).—Prussian blue, 6 parts; emerald green, 9 parts; white lead, 5 parts.

Green (Olive).—White lead, 12 parts; yellow ochre, 4 parts; umber, 1 part.

Green (Oriental).—White lead, 2 parts; lemon chrome, 2 parts; umber, 1 part.

Green (Pale).—Zinc green, 4 parts; zinc white, 5 parts.

Green (Pale Emerald).—White lead, 2 parts; emerald green, 1 part.

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Green (Pea).—White lead, 100 parts; lemon chrome, 1 part; light green, 13 parts.

Green (Peacock).—White lead, 7 parts; emerald green, 50 parts; Prussian blue, 43 parts.

Green (Pistache).—Black, 7 parts; yellow ochre, 1 part; chrome green, 1½ parts.

Green (Prussian).—Prussian green. Or compound with emerald or medium chrome green, 12 parts; chrome yellow, 3 parts; black, 5 parts.

Green (Sage).—White lead, 30 parts; chrome green, light, 2 parts; burnt sienna, 1 part.

Green (Sea).—White lead, 100 parts; deep green, 4 parts.

Green (Slate).—White lead, 16 parts; black, 5 parts; raw turkey umber, 1 part; deep green, 3 parts; blue, 1 part.

Green (Velvet).—Burnt sienna, 3 parts; light chrome green, 5 parts; white lead, 8 parts.

Green (Water).—White lead, 25 parts; deep green, 1 part; yellow ochre, 5 parts.

Gray (Argent).—Black, 9 parts; white lead, 16 parts; red, 1 part; trace of orange.

Gray (Ash).—Burnt sienna, 2 parts; ultramarine blue, 3 parts; zinc white, 60 parts.

Gray (Dove).—White lead, 50 parts; ultramarine, 4 parts; ivory-black, 1 part.

Gray (Greenish).—White lead, 100 lbs.; medium chrome yellow, 8 oz.; medium chrome green, 1 lb.; lampblack, 1 oz.

Gray (Jasper).—Black, 9 parts; white, 2 parts; trace of deep chrome.

Gray (Light).—Prussian blue, 1 part; lampblack, 1 part; white lead, 10 parts.

Gray (Light).—Tint white lead with a little each of lampblack, raw umber, and Prussian blue.

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Gray (Light French).—White lead, 200 parts; ivory-black, 2 parts; blue, 1 part.

Gray (Opal).—Burnt sienna, 1 part; zinc white, 30 parts; cobalt blue, 2 parts.

Gray (Pearl).—White lead, 50 parts; Venetian red, 2 parts; deep green, 2 parts.

Gray (Pure).—Raw turkey umber, 1 part; ivory-black, 1 part; white lead, 40 parts.

Gray (Silver).—White lead, tinted slightly with a touch of lampblack and raw umber.

Gray (Warm).—White lead, 100 lbs.; French ochre, 4 to 6 lbs.; lampblack, 2 oz.; Venetian red, 2 oz.

Hay.—White lead, 100 parts; yellow ochre, 4 parts; raw umber, 4 parts; deep green, 1 part.

Heliotrope.—Zinc white, 2 parts; red, 3 parts; ultramarine blue, 4 parts.

Indigo.—Indigo. Or compound with black, 9 parts; Prussian blue, 4 parts.

Ivory.—White lead, 56 parts; yellow ochre, 2 parts; Venetian red, 1 part.

Ivory.—Tint white lead with raw sienna and a touch of American vermilion.

Lavender.—White lead, 100 parts; ultramarine, 3 parts; madder lake, 1 part.

Lead.—White lead, 100 parts; ivory-black, 8 parts.

Leather.—White lead, 20 parts; yellow ochre 4 parts; Venetian red, 2 parts.

Lemon.—Lemon chrome. Or compound with chrome 5 parts; white lead, 2 parts; very little green.

Lilac.—White lead, 100 parts; ultramarine, 1 part; rose madder, 1 part.

Limestone.—White lead, 100 parts; yellow ochre, 1 part; raw umber, 1 part.

Mahogany.—Orange chrome, 10 parts; burnt sienna, 3 parts; white lead, 1 part.

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Maple.—White lead, 100 parts; yellow ochre, 3 parts; raw umber, 1 part.

Maroon.—Venetian red, 2 parts; Indian red, 4 parts; lampblack, 1 part.

Maroon (Acacia).—Black, 4 or 5 parts; Indian red, 3 parts; Prussian blue, 1 part.

Maroon (Black).—Black, 4 parts; bright red, 1 part; trace of Prussian blue.

Mascot (Blue).—Black, 7 parts; blue, 1 part; trace of green.

Mauve.—White lead, 6 parts; Prussian blue, 2 parts; madder red, 1 part. Or add blue to brown.

Mouse Color.—Lampblack, 3 parts; Prussian blue, 1 part; white lead, 16 parts.

Oak (Dark).—White lead, 2 parts; yellow ochre, 3 parts; Venetian red, 1 part; umber, 3 parts.

Oak (Light).—White lead, 6 parts; yellow ochre, 6 parts; Venetian red, 2 parts; umber, 1 part.

Ochre (Golden).—Yellow ochre, 5 parts; lemon chrome, 2 parts.

Ochre (Roman).—Yellow ochre, 50 parts; turkey umber, 3 parts.

Old Gold.—White lead, 6 parts; ochre, 12 parts; middle chrome, 3 parts.

Olive.—White lead, 12 parts; yellow ochre, 4 parts; ivory-black, 1 part.

Olive (Gray).—Chrome green, 1 part; lampblack, 3 parts; white lead, 40 parts.

Olive (Light).—Middle chrome, 3 parts; black, 2 parts; burnt sienna, 1 part; trace of white lead.

Olive (Yellow).—Burnt umber, 3 parts; lemon chrome yellow, 1 part.

Orange.—Orange chrome, 18 parts; white lead, 1 part; yellow, 1 part.

Orange (Bright).—Orange chrome, 1 part; orange lead, 2 parts.

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Orange (Scarlet).—Orange lead, 2 parts; white lead, 1 part.

Orange (Persian).—Orange chrome, 14 parts; white lead, 1 part; yellow ochre, 5 parts.

Peach Bloom.—Indian red, 3 parts; white lead, 17 parts.

Pink.—White lead tinted with American vermilion.

Pink (Aurore).—Indian red, 1 part; orange chrome, 2 parts; blue, 2 parts; trace of lemon chrome; tint with white.

Pink (Coral).—Vermilion, 5 parts; white lead, 2 parts; chrome yellow, 1 part.

Pink (Indian).—White lead, 100 parts; Indian red, 3 parts; rose madder, 1 part.

Pink (Light).—White lead, 100 parts; rose madder, 4 parts; vermilion, 1 part.

Pink (Royal).—Zinc white, 2 parts; carmine lake, 2 parts.

Pink (Venetian).—White lead tinted with trace of Venetian red.

Porcelain (Blue).—Zinc white, 1 part; chrome green, 1 part; ultramarine blue, 4 parts; trace of black.

Primrose.—Pale zinc chrome. Or compound with: White lead, 10 parts; green, 3 parts; yellow, 4 parts.

Purple.—White lead, 1 part; ultramarine, 1 part; Indian red, 1 part.

Purple (Anemone).—Black, 2 parts; white lead, 1 part; bright red, 6 parts; Prussian blue, 6 parts.

Purple (Begonia).—Lampblack, 4 parts; bright red, 5 parts; Prussian blue, 4 parts.

Purple (Royal).—Royal purple. Or compound with: Vegetable black, 2 parts; red, 3 parts; Prussian blue, 14 parts.

Red (Armenian).—Yellow ochre, 1 part; Venetian red, 2 parts.

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Red (Bordeaux).—Black, 1 part; orange chrome, 2 parts; Prussian blue, 1 part.

Red (Carnation).—Carmine lake, 3 parts; white lead, 1 part.

Red (Cherry).—Rose madder, 1 part; vermilion, 2 parts.

Red (Deep Indian).—Indian red, 5 parts; lampblack, 1 part.

Red (Egyptian).—Black, 10 parts; white, 3 parts; orange, 4 parts; blue, 2 parts; trace of red.

Red (Geranium).—Bright red, 9 parts; blue, 1 part.

Red (Light Indian).—Venetian red, 1 part; Indian red, 3 parts.

Red (Mexican).—Red lead, 1 part; Venetian red, 4 parts.

Red (Mikado).—Blue, 3 parts; red, 7 parts; small quantity of white.

Red (Moorish).—Vermilion, 3 parts; rose pink, 1 part.

Red (Orange).—Orange chrome.

Red (Oriental).—Rose madder, 2 parts; orange lead, 1 part.

Red (Poppy).—Blue, 1 part; vermilion, 24 parts.

Red (Turkish).—Pale vermilion, 4 parts; mahogany lake, 1 part.

Red (Tuscan).—Rose pink, 2 parts; Indian red, 4 parts.

Rose (Carnation).—Rose madder, 1 part; zinc oxide, 8 parts.

Rose (Light).—White lead tinted lightly with rose lake, turkey red, or vermilion.

Rose (Old).—White lead, 16 parts; crimson madder, 1 part.

Rosewood.—Bright red, 1 part; black, 6 parts; trace of green.

Russet (Dull).—White lead tinted to desired shade

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with raw sienna and a touch of vermilion or Indian red.

Salmon.—White lead, 40 parts; golden ochre, 5 parts; Venetian red, 1 part.

Sapphire.—Zinc white, 4 parts; Chinese blue, 1 part.

Scarlet (Bright).—Vermilion, 20 parts; pale chrome, 7 parts; golden ochre, 1 part.

Scarlet (Orange).—Orange lead, 2 parts; white lead, 1

part.

Slate.—White lead, 100 parts; ivory-black, 3 parts; ultramarine, 1 part.

Snuff.—White lead, 9 parts; orange chrome, 1 part; burnt umber, 2 parts.

Stone.—Burnt umber, 1 part; French yellow ochre, 2 parts; white lead, 5 parts.

Stone (Bradford).—White lead, 100 lbs.; raw sienna, 3 lbs.; shade with lampblack.

Stone (Brown).—Burnt umber, 10 parts; golden ochre, 1 part; burnt sienna, 2 parts.

Stone (Dark).—White lead, 20 parts; yellow ochre, 12 parts; raw umber, 4 parts; Venetian red, 1 part.

Stone (Light).—White lead, 100 parts; and either Italian ochre, 5 parts, or yellow ochre, 6 parts.

Stone (Middle).—White lead, 100 parts; yellow ochre, 12 parts.

Tan.—White lead, 20 parts; burnt umber, 6 parts; burnt sienna, 3 parts; yellow ochre, 2 parts.

Tan (Auburn).—Burnt umber, 1 part; golden ochre, 3 parts; white lead, 20 parts.

Tan (Coffee).—White lead tinted with burnt umber.

Tan (Soft).—Tint white lead with raw sienna.

Tan (Warm).—Tint white lead with raw sienna, chrome yellow, and vermilion.

Terra Cotta.—White lead, 2 parts; burnt sienna, 1 part.

Terra Cotta.—White lead, 2 parts; Venetian red, 1 part; burnt sienna, 1 part.

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Turquoise.—White lead, 20 parts; ultramarine, 2 parts; light green, 1 part.

Violet.—French ultramarine, 14 parts; crimson lake, 3 parts.

Violet (Transparent).—Ultramarine blue, 4 parts; crimson lake, 1 part.

Walnut.—Burnt umber, 5 parts; raw sienna, 1 part.

White (Clear).—White lead, 300 parts; ultramarine, 1 part.

White (Flake).—Pure English white lead.

White (Kremnitz).—Pure zinc oxide, 100 parts; ultramarine, 1 part.

White (Permanent).—Finest barytes, 200 parts; blue, 1 part.

White (Pure).—Equal parts white lead and zinc white.

White (Translucent).—White lead, 1 part; barytes, 10 parts.

White (Transparent).—Zinc white, 1 part; barytes, 20 parts.

Yellow (Alabaster).—White, 4 parts; middle chrome yellow, 1 part.

Yellow (Light Colonial).—White lead, 100 lbs.; medium chrome yellow, 1 to 2 lbs.; raw sienna, 1 lb.

Yellow (Orange Chrome).—Use orange chrome yellow or same plus a touch of vermilion.

Yellow (Light Orange Chrome).—Use orange chrome yellow and a little white lead.

Yellow (Brass).—White lead, 40 parts; light chrome yellow, 12 parts; raw umber, 1 part; burnt umber, 1 part.

Yellow (Bronze).—White lead, 10 parts; lemon chrome, 4 parts; raw umber, 5 parts.

Yellow (Buttercup).—Middle chrome.

Yellow (Canary).—White lead, 10 parts; lemon chrome, 1 part.

Yellow (Chamoline).—Raw sienna, 3 parts; lemon yellow, 1 part; white lead, 5 parts.

Yellow (Chamois).—White, 4 parts; yellow ochre, 5 parts; green, 1 part.

Yellow (Citrine).—Raw umber, 2 parts; lemon chrome yellow, 5 parts.

Yellow (Golden).—Middle chrome, 16 parts; yellow ochre, 1 part.

Yellow (Italian).—Yellow ochre, 14 parts; burnt umber, 1 part.

Yellow (Jonquil).—Indigo, 1 part; light red, 2 parts; white lead, 16 parts; tint with chrome yellow.

Yellow (Lemon).—Lemon chrome.

Yellow (Olive).—Burnt umber, 3 parts; lemon chrome yellow, 1 part.

Yellow (Primrose).—Pale zinc chrome.

Yellow (Transparent).—Yellow ochre, 1 part; barytes, 10 parts.

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CHAPTER V

WORKING OPERATIONS

Size of Stencil.—The size of a stencil ornament must be carefully figured in proportion to the size of the room or the panel. It will not look well if either too large or too small in size. A large stencil is needed for large wall spaces and high ceilings; a small one for small panels and walls.

The higher up and farther away a stencil is used, the stronger it may be made in both design and coloring, in order to assure its being seen. Likewise, rooms that are not well lighted permit the use of stronger coloring and designs than may be used in light rooms.

The surest way to handle such problems is to lay out roughly large rooms, such as church auditoriums, lodge halls, etc., to scale on a piece of paper. By this means you can easily work out the problem before hand, and determine stencil sizes, the number of repeats, the connections, and colors.

It is not best to combine stencil patterns with other means of decoration; that is, with wall paper, for instance.

When to Transfer Stencils.—Ordinary stencils, color stencils, and background stencils are transferred to the wall after the ground coat and the glazing coat have been completed and are dry.

Outline stencils are to be transferred to the ground coats when dry, and before any glazing color has been put on. Outline stencils should become dry before beginning to glaze over them. The design will show through the glazing coat. The glazing color ought to be

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wiped out between the lines of an outline stencil, so that the ground color will show through.

LAYING OUT FOR STENCILS AND SPACING

The best decorators usually mark off with a chalkline a horizontal center line, or two lines defining the outer edges of the stencil to be transferred. The chalkline is coated with chalk, held taut against the wall by a man at each end, and then, by pulling the center of the line away a few inches and letting go, a straight chalk mark is snapped on the wall.

Practically every room is out of plumb and is not level. Rooms do not measure accurately. You can see, then, the necessity of having chalklines carefully laid out by measure, which can be followed with the stencil plate.

With a repeat pattern, one setting may be out of line only a small fraction of an inch, but by the time several settings or transfers have been made, the inaccuracy becomes so great that the pattern does not match up and does not run straight.

It is often advisable to run chalklines both horizontally and vertically, notably with all-over diaper stencils, in order to secure accuracy. The horizontal lines are marked off a certain number of inches below or above a picture mould, below a cove mould or cornice, regardless of the fact that in so doing the line at one end of the room may not be the same distance from the floor as at the other end. In other words, make your stencil run exactly parallel with the picture mould, or whatever line it is nearest to, and not with the floor.

Perpendicular lines had best be run perfectly straight up and down, because the corner lines on each side of the wall may be running at different angles from each other. Take a carpenter's plumbline, mark off a true vertical line in the center of each wall with it, and

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then mark all other vertical lines, if any are needed, parallel to it.

It is especially necessary to run these true chalk lines when placing all-over or diaper stencils. A line being out of place even as little as one-eighth of an inch at one end, will cause a misfit of the pattern. It will not match at the end.

Where to begin the transfer of a stencil design is often a little puzzling at first thought. The answer to the question will come easily, however, after sizing up the room construction and noting the character of the stencil.

Certain stencils consist of a succession of figures, repeated constantly like the links of a chain, while others include continuous lines that are broken regularly by figures in pairs, triplets, or quads, like the grapevine design in Plate 19, with its clusters of grapes and of leaves.

The first class of stencils can obviously be placed on the wall to begin and end without reference to spacing, except the last link or two in the chain, which you may have to make a little longer or shorter than the others, to make it meet the first one. A continuous design, like

the chain bands, is usually started on the right-hand side of the wall and transferred working to the left.

It is not so with the second class of stencils. They ought to be started at a point on the wall that will locate the principal parts of the design regularly in the panels or spaces between corners, rather than have an odd number of groups in a wide panel poorly spaced, or have a principal part finished in a corner. It may be necessary to transfer the lines or band portions of this stencil (which connect the principal parts) more often than the strong parts, to gain a nice balance and spacing. See Plate 20, the central illustration.

When three sides of a wall have been stenciled with a pattern of the second class, and the central

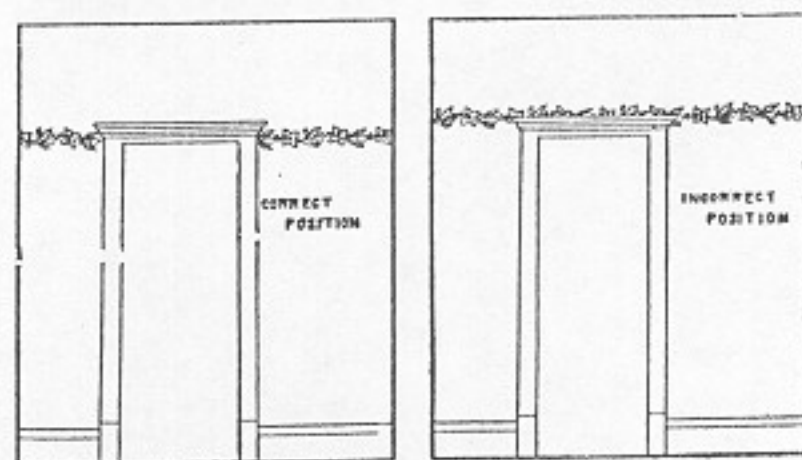
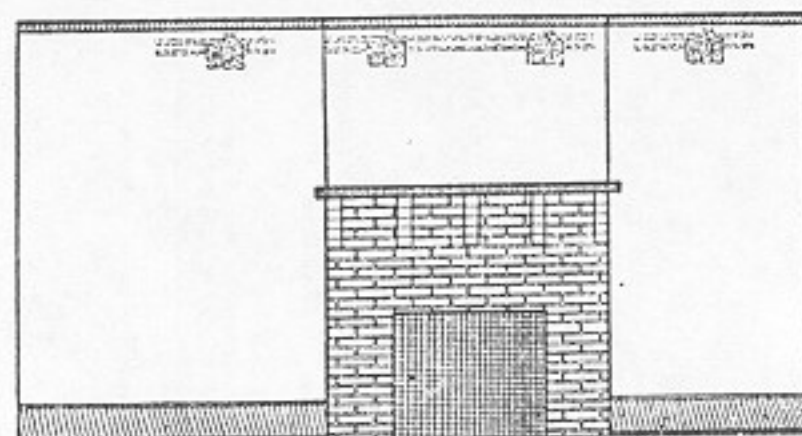
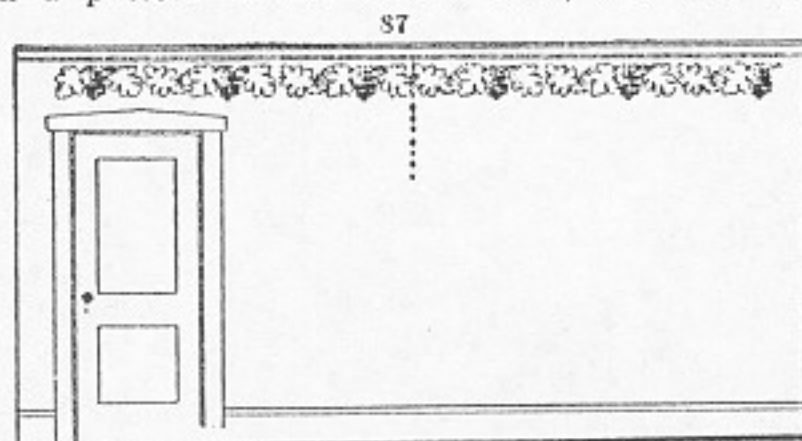


Plate 20.—Methods of Laying Out and Spacing Stencils.

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figures are nicely spaced, turn the corner on to the fourth side and transfer one section. Now measure the wall yet to be stenciled; divide this distance by the length of your stencil, and you get the number of times you must use the stencil to finish the wall. Probably it will figure so that a certain number of transfers will fall short or be too long to match up exactly at the beginning.

Thus, if, for instance, five transfers of the stencil fall

short of meeting the other end of the stencil by five inches, you must gain one inch on each of the five settings of the stencil to come out even. So, in using the grapevine stencil mentioned, begin your second transfer, after turning the last corner on this wall, one inch from the end of the previous setting, and so on with each transfer of the stencil, and you will have gained five inches and come out evenly matched. Fill in the one-inch breaks by freehand, or with the stencil over them.

Another Method.—Another and better way, perhaps, to handle a design composed of strong or principal figures recurring regularly, is to mark a chalk line up and down in the center of each of the four walls. Place the center of the grapevine stencil over the line and transfer the first impression to the wall. Place the next setting to the right, and continue the impressions until the last setting of the stencil brings the design within a foot or so of the corner. Then, go back to the center and transfer the pattern until near the left corner in the same manner. Stencil all four walls in this way, leaving the corners unfinished until the last. By the time you get around to them the paint on the corner ends of the stencil pattern will be dry enough to work over and you can then crease the stencil and carry the design around the corner and match up at both ends. Do not permit the leaves and grapes to locate in the corners, but on either side. Plate 20 shows this method of laying

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out the work. This method will not succeed with all stencil designs, however.

Treatment of Mantels, Etc.—When a room includes a chimney, fireplace, or mantel, the stencil design should be so started as to bring one, two, or three of the principal figures so as to occupy the wall over the chimney in a balanced manner. See the center illustration, Plate 20.

In placing detached spot designs, study the room construction. Note about how many settings will look best. Measure to locate them, and then proceed to transfer these impressions first. When all are on, place chalk lines running between these principal figures, to mark the location of the stencil band or lines which are to connect all figures into one continuous scheme.

Arrange to have equal spaces between these principal figures, or at least balance up the spaces on walls of the same size. Do not, however, place any of the central motifs in corners.

HOW TO TRANSFER THE STENCIL

Tidiness in keeping the back of the stencil and your fingers clear of color, so that the wall will not become marked and soiled, is the first requirement for a successful transfer. The stencil must lie flat on the wall in transferring it. Have a clean pot and brush for each color. A picture mould or chalk line should be used as a guide to keep the stencil running straight and in the proper place.

When a pattern is continuous and is to be regularly repeated time after time, it is, for the sake of general effect, absolutely necessary that the impressions shall be joined together so accurately that not the slightest un-

evenness is left to show where the joints occur.

To make it easy to connect up each section of a continuous stencil band, which is transferred one section at a time, the stencils are usually so designed that the last

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portion of the pattern on the stencil plate is incomplete. Perhaps only one-half of the last leaf or bunch of grapes, for instance, shows on the plate. Or sometimes one extra leaf or stem from a group is shown on the left-hand side of the stencil plate, as a guide to follow when the plate is lifted to transfer the next section. The right-hand side of the stencil plate is then lapped over the last figure transferred to the wall, which insures perfect register and alignment. See Chapter III about guide marks.

Begin to transfer the stencil in the right-hand corner or center of the wall, holding it with the left hand and using the brush with the right. Hold the brush at right angles to the stencil. With the stencil plate on the wall the brush handle should point straight out toward you. The brush should be used like a hammer rather than be rubbed over the stencil, as a brush ordinarily is used. Swing the brush back and forth, so it will pound the wall through the stencil holes.

When the brush is held at any other angle than a right angle, the bristles get under the stencil and produce a ragged, mussy edge.

When the transfer is complete in the first position, lift the stencil carefully, pulling it straight out to avoid smearing. Wipe off the back of the stencil plate as often as is necessary with benzine, to keep it clean. To avoid injury, lay the stencil on a flat surface when wiping it off.

Have a helper hold the stencil for you at first, or fasten it to the wall with push pins. Large stencils are usually a two-man job, or they must be fastened with push pins so that the left hand is free to press the stencil against the wall while working the brush over the openings. It is an advantage at times to tack a strip of wood, like a lath, on the top and on the bottom of large stencils, to help hold them in place. Tack it on the face of the stencil, letting the brads go through and extend beyond

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the stencil plate a trifle. The points will help hold the stencil steady by penetrating the wall a little.

Gelatine Mixture.—A gelatine mixture is used sometimes to eliminate the use of stencil pins or push pins when working with stencil plates. One ounce of gelatine is soaked for twenty-four hours in four ounces of water, and then heated in the inner vessel of a double pot, water being placed in the outer vessel. The whole is placed over a slow fire. (A glue pot answers the purpose admirably.) When melted, six ounces of glycerine are added and two ounces of fine sugar, all the ingredients being measured by weight. The mixture should be allowed to get fairly hot, but not to boil. For some surfaces, such as flat paint and distemper, a somewhat stiffer mixture, obtained by using more gelatine, will give better results and not leave marks on the surface.

The four corners of the stencil plate (and one or two other convenient points if the stencil plate be large) are

coated with the hot mixture and allowed to cool. If the places to be coated are punctured with a number of fine holes first, the coating will adhere quite firmly. The burr caused by puncturing should be removed with glasspaper before coating, or the projections may prevent the tacky surface from properly adhering to the wall during operations.

A stencil plate so treated has only to be laid on the surface and pressed into contact, and it will remain fixed in its place while the stencil brush is operated. It can be removed at will, leaving no trace of its attachment. This method not only saves time, but it does away with the unsightly holes made by the use of stencil pins.

Masks for use with stencil plates can be temporarily fixed in like manner, in cases where it is necessary to prevent some of the cut-out places becoming marked with the color of the remaining cut-outs.

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A pot of the gelatine mixture will keep almost indefinitely and can always be warmed up for use.

Keeping the Color Even.—When transferring stencil impressions to a wall, a surprisingly dry brush works best. Runs, round edges, and messy effects result nine times out of ten from too much color in the brush, or from using a too thin color mixture.

Never dip the stencil brush in a pot of color. Use another small brush to spread a little of the color on a board or a palette. Then pick up the color from the board on the bristle ends of the stencil brush. When the color works up into the heel of the brush after long use, wash it out. By this method you can easily keep a uniform amount of color on the board, in the brush and on the stencil design.

It is essential that you add a little turpentine to your pot of color every few hours, to make up for that which has evaporated. If you do not, the stencil pattern will not possess a uniform color.

The Stencil Brush.—(See Plate 19.) Stencil brushes of various sizes can be had from $\frac{3}{8}$ of an inch to 3 inches in diameter. Use No. 2 for small and No. 4 for large stencils. It is important that the correct size brush be used for each stencil.

Use of the Sponge.—For the purpose of transferring a stencil impression in calcimine, cold water paint, or distemper, a sponge is the tool to use rather than a stencil brush. Soak the sponge in cold water and then squeeze out as much as possible. Mix the color and size stiff, so that it can be pressed into a cake and will hold together. If you get it too hard, the sponge will not pick it up. Rub the sponge over the cake to pick up color, hold the stencil close to the wall with the fingers, and proceed to rub the colored tips of the sponge over the stencil openings in a circular manner. Don't press too hard, and don't rub straight over the openings, or

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runs are likely to occur to spoil the work. The sponge must not contain too much water or color. A comparatively dry sponge makes the cleanest and sharpest impression.

A small sponge is sometimes used for oil color stenciling to produce a little different effect than with a brush. The sponge must be cleaned out in benzine often.

MIXING STENCIL COLORS

Colors used in transferring stencils may be either tube glazing colors or ordinary house tinting colors which have been thinned with the glazing liquid, composed of one-fourth linseed oil and three-fourths turpentine. Some painters prefer three-fourths turps and one-fourth japan gold size.

In Tiffany wall glazing, the outline stencil is transferred with burnt umber usually, regardless of the colors that will finally be used to fill in the stencil, although it is not necessary to use it. Any dark color will do. An outline stencil transferred with whiting, dry raw umber, and glue water will dry quickly, so that you can glaze immediately over it.

Color mixed for stencil use ought to be of a thick consistency, about like thick cream. Do not use too much japan, or the color will dry with a gloss.

Opaque colors are mixed by tinting white lead to the desired shade with oil-ground colors, and thinning the same as for transparent colors.

To Stencil on Calcimine.—For this purpose use colors ground in turpentine and thinned with japan gold size, colors ground in japan and thinned with turpentine, or colors ground in oil and thinned with gasoline. It is well to draw the oil out of the lead first by mixing with benzine and letting it settle. A little japan gold size ought to be added as a binder. Sometimes one of these will work better than the others. Try the color on a hidden or re-

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mote portion of the room before stenciling the whole room. It will be easy to see whether the color is going to spread or not.

When calcimining a wall to be stenciled, the size binder ought to be made stronger than the binder of the stencil color.

Another way to stencil with calcimine, water or distemper colors on the same kind of surface, is to mix the dry color to a paste with water and add a little cooked starch to bind it together. A few drops of turpentine in the water will help prevent clogging of the stencil.

While stenciling with water colors and calcimine, the paper stencil gets soft from the water and must be dried out every little while. Have two stencils, so one can be drying while you are working with the other.

To Stencil on Paper.—Use colors ground in oil or lead, tinted to suit. Mix first with benzine, let stand, and pour off all liquid. Mix again with gasoline or benzine and a little japan gold size to bind it.

STENCILING WITH METAL BRONZES AND LEAF

For theater decoration, churches, and in some other places it is sometimes desirable to transfer a whole stencil pattern in gold, copper, silver, or aluminum bronze, or a mixture of two of these. There is also frequent occasion to produce nice effects on spot designs used in panels, as shown by Plate 21. Comparatively

small areas, termed *jewel points*, can be nicely set off in bright metal leaf or bronze, and it will improve the whole decorative scheme.

Bronze Powders.—For the application of gold, silver, copper, or aluminum bronze powders, either oil gold size or japan gold size can be used with a stencil in the ordinary way. Japan gold size is preferred. With it the metal doesn't tarnish as soon as with oil gold size.

Oil gold size will set in about 24 hours and become

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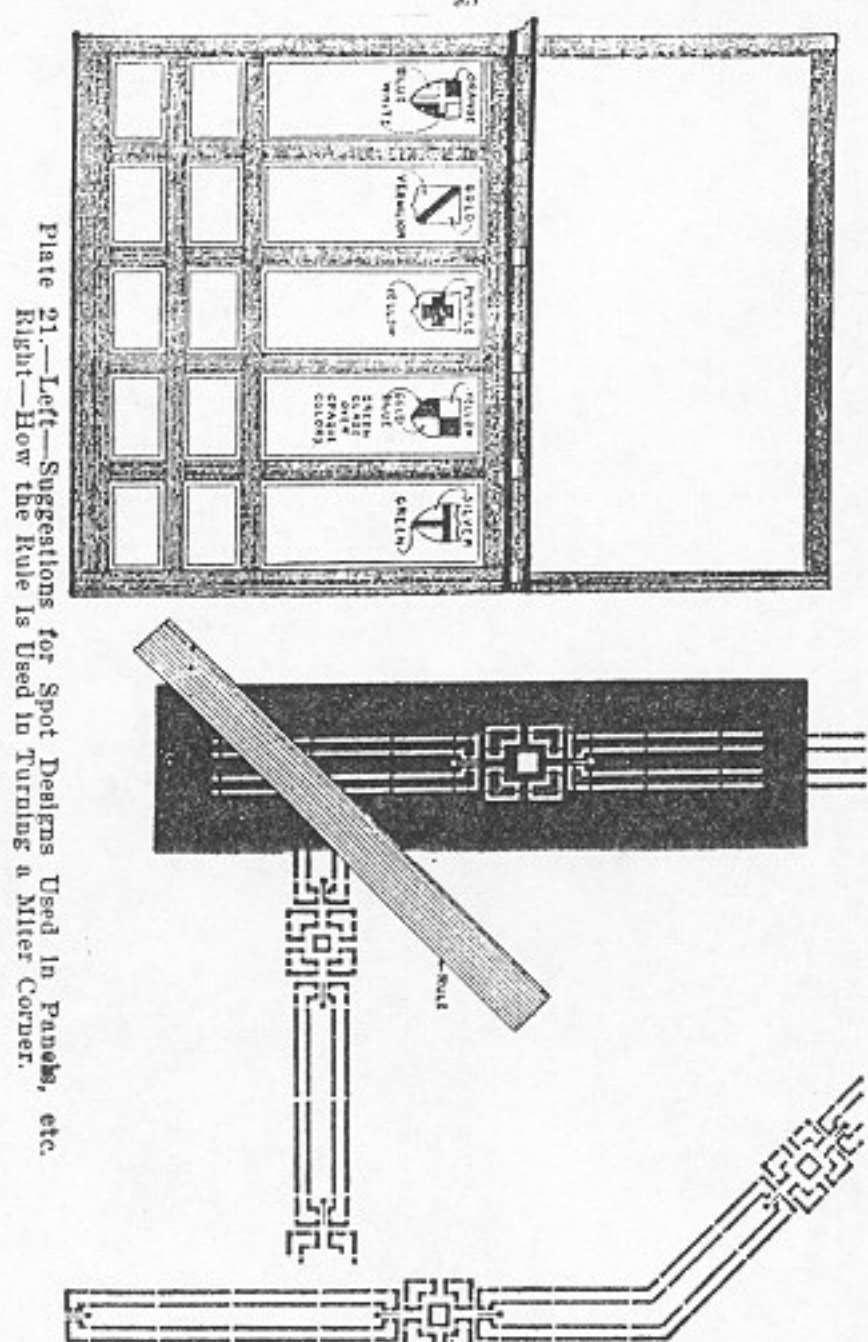


Plate 21.—Left—Suggestions for Spot Designs Used in Panels, etc. Right—How the Rule is Used in Turning a Miter Corner.

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ready for gilding. Japan gold size will be sufficiently tacky in from 10 to 30 minutes, according to its drying power. The period of time during which the metal powder or leaf may be applied to japan gold size is much shorter than with oil size.

Bronze powders can then be dusted on with a pad of cotton when the size is just sticky enough to hold it. If you wait too long, the size will set hard and then the bronze will not adhere to it. It is well to add a little color to the size, red for gold, yellow for copper, etc.

Or another and quicker way is by use of the following mixture put on with a stencil brush: Mix bronze powder with 1 gill pure honey to a smooth paste, 1 teaspoonful refined glycerine, enough soft water (boiled) to make of the right consistency for the brush. If it sets too rapidly, add more glycerine.

Or mix the bronze powder with good varnish, thinned with turpentine or benzine to brushing consistency. Put on with a brush. Bronzing liquid will also do.

Metal Leaf.—Gold, silver, and aluminum metal leaf, also Dutch metal leaf, are put on to small areas and jewel spots in the same manner as the sign painter uses it for letters. The areas are coated with japan gold size or oil gold size (using a small fitch as the brush), and allowed to stand until sticky enough to hold the leaf. Then the leaf is picked up out of the book with a gilder's tip (a brush), after rubbing it on the hair of the head to gather static electricity. The leaf can then be laid on to the sticky size. Smooth down with a wad of cotton and let dry. After twelve hours burnish the metal with cotton and brush off the ragged edges of the leaf which are outside of the design being gilded. The size is brushed on only within the outline of the part of the design to be gilded, but the leaf is put on in square shaped pieces which overlap the edges of the design. The leaf will adhere only where there is size.

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Do not lay the metal leaf on to the size too soon, that is, while the size can be pushed around on the surface with the finger, or the metal will become dull soon after applying it. If you wait too long, the size will dry hard and then the metal will not adhere to it at all. Follow the directions, as to time allowed for setting, given by the manufacturers of the size being used.

Brightening Jewel Points.—There are various ways to fill in these spot designs to make them brighten up and add life to the room. As just suggested, they may be filled in solid with bronze powder or with metal leaf and burnished. Then, if varnished to exclude the oxidizing action of the air, the metal will remain bright for a long time.

Sometimes these jewel points are filled in solid with brilliant reds, yellows, greens, and blues in opaque colors, instead of metal.

However filled in, whether with metal or opaque color, it is well to brush on a thin glaze coat of transparent color over the top of the metal or opaque color. This gives a depth and sheen which enriches the ground color.

For instance, if the ground is gold bronze, gold leaf, or bright chrome yellow, coat over the top with a thin glaze, a stain, made by thinning American vermilion or rose lake, with one-fourth linseed oil and three-fourths turpentine, or use varnish and turpentine as a thinner. Over a silver, aluminum, or white ground, lay a cobalt blue glaze. Over copper or gold ground lay a medium chrome green glaze.

TURNING CORNERS

In turning corners when stenciling a wall, first bend the stencil by laying it down flat on a table and placing a straight-edge at the point where the bend is to come. Bend the stencil over with the hand to crease it sufficiently. The point at which to make the crease is determined

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by measuring, after transferring the stencil pattern to within a few feet of the corner to be turned.

A corner chimney that projects can be stenciled without bending the stencil; that is, transfer one side of the chimney at a time. An extra stencil for corners is handy.

Turning a Miter Corner.—To turn a corner with some stencils, transfer them nearly up to the corner, letting about one-half of the stencil plate run over and beyond the point where the turn comes. Place a rule or piece of paper over the stencil plate at the correct angle to form the corner miter. Hold with left hand and transfer the stencil up to the corner. See Plate 21. Take up the stencil plate, turn the corner, and repeat by holding the rule over the half of the corner just transferred, and in the position indicated by the drawing.

TOUCHING UP TIES

Difference of opinion has long existed among decorators as to the advisability of touching up stencil impressions with a brush, to rectify imperfections and to eliminate the blank spaces left by the ties. On outline stencils it should not be done.

From the standpoint of the labor cost of touching up many rough places, it is obvious that the objection is well founded. From the artistic viewpoint, the practice is objected to justly, because the brush touching-up must be skillfully done or shiny spots of color, brush marks, and a different texture will be noticed. If the stencil is so poorly cut as to make much touching up necessary, cut a better one. If the man is careless about his color, correct him. Clean stencils (both sides) and ordinary care will do away with touching up.

As to painting out the tie marks,—many stencils are so artistically designed that the tie blanks are an addition to their good appearance. Plates 5, 13 and 17 show designs, the ties in which ought not to be filled in.

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On the other hand it is poor judgment to permit such designs as 1804 and 1212 on Plate 1 to be considered finished without touching up the ties.

Use color and turpentine, no oil, for touching up. A fine soft brush is needed and do not make a single unnecessary stroke of the brush. Cover the spot with material and let it alone. Fill in ties while the stencil color is wet. Brushing makes shiny spots. Also remember that the stencil brush makes a rough surface. Don't make your touched-up spots too smooth.

FILLING IN COLOR ON OUTLINE STENCILS

Before beginning this work it is obviously necessary that the stencil shall have been transferred to the surface, in burnt umber color or with a dull gray green. It may be transferred, of course, with any color which fits in with your color scheme, but usually it is brown or dull green outline, as stated. This should be dry before filling in with other colors.

Colors used for filling in purposes are the semi-transparent glaze colors listed in the chapter on color. Opaque colors are seldom used, but can be for emphasizing certain parts of the ornament. Thin the color to a brushing consistency with turpentine. When it sets up too quickly to permit brushing it out smoothly, add a few

drops of linseed oil. Make no attempt to cover the surface solidly to hide it. Just stain the surface within the outline of the design, permitting the ground color and the brown or gray color of the stencil to show through the glaze color. Spread the glaze color over the top of the stencil lines, as well as between the lines.

Filling in outline stencils after the glaze coat of Tiffany finish or last coat of flat wall paint has become dry, is freehand work and is accomplished by the use of round and flat fitches of various sizes, ranging from about $\frac{1}{8}$ inch to 1 inch according to the size of the stencil.

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You will need some sharp, also square point fitches. See Plate 22. Begin filling in the stencil by coloring one part, for instance the flower or leaves, that may form the central portion of conventional patterns. Carry the operation all around the room before beginning with the next color.

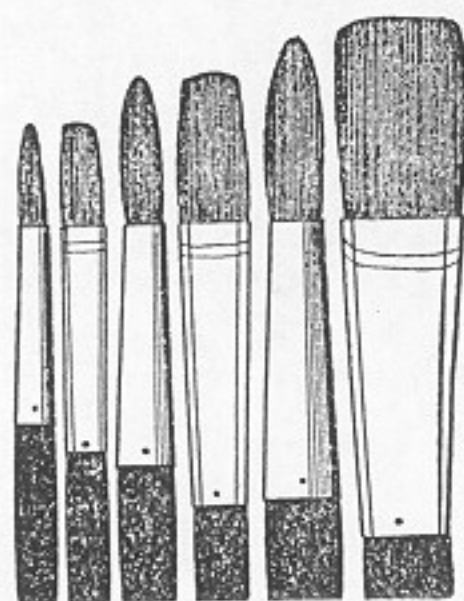


Plate 22.—Fitches Used in Stenciling; Below, Suggested Treatment of a Small Pond-Lily Border.

If two colors are to be used on the central figure of the pattern, fill in the light color first at the outer edge of flowers, the conventional design, or the outer tips of the leaves. The center of the figure is then filled in with a darker color, to form the shadows. For shading have the brush nearly dry. Too much color in it spoils

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the work. With a clean brush blend the light color gradually into the darker center color. Do not begin the other way around, working the dark color into the light, because you will then get the entire figure too dark.

When making outline stencils, such as that shown in the lower left-hand corner of Plate 17, which are usually filled in freehand with a small fitch, using semi-transparent colors, it is often desirable on large walls and when the work has been taken at a low price, to make a second stencil plate which will fill in the color between the lines of the outline stencil. That saves labor, as the filling in of color progresses much more rapidly using a stencil than when a fitch is the tool.

In the lower right-hand corner of Plate 17 is shown

the impression from the stencil plate used to fill in a color on the outline stencil impression to the left of it. The making of this second color plate is simple. Transfer an impression from the outline stencil plate to a clean sheet of stencil paper. Then mark off ties and cut out the solid paper *between* the lines.

Working on the wall with these two stencil plates, the one to the lower right of Plate 17 would be transferred first in one color,—a light color usually. Then the outline stencil would be transferred on top of it in a darker color, often raw or burnt umber. The outline stencil plate simply makes a dark border around the light color put on by the color plate.

In coloring flowers the tips of the petals should, of course, show the light tint and the darker shade comes in the center of the flower. With fruit, pottery, and the like, decide beforehand where the high light would naturally fall; then shade outward from there to the edge, making the color darkest around the high light.

It is sometimes desirable to blend together two or more colors that may come alongside of each other. It may easily be accomplished by lightly patting the work with

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a small wad of cheese cloth, but do not rub it. Blending colors does not mean mixing them together to form a third color. It means spreading one clear color over another, so that both remain pure. When worked too long they mix.

When filling in stencils, avoid violent contrasts and spotty stencil effects. Fill in every other, or every fourth or fifth, flower or space if necessary to preserve the continuity of design and avoid spotty effects. A uniform soft general effect is the standard to work for.

WIPING OUT HIGH LIGHTS AND SHADING

Light and shadow in leaves can be obtained as above, or fill in the leaves solidly with the dark color, and with a piece of cheese cloth wrapped around the first finger, wipe the color out of the tips of the leaves, allowing the light-colored ground coat to show through and form the high light. Wipe lengthwise of the leaf, not across. It may be necessary to dampen the cloth with turps.

The same may be done in producing high lights on fruit or other details that ought to show them. Conventional designs and geometrical figures are often wiped out in the centers or in other portions arbitrarily, taking care only to give a good effect.

Study flowers particularly for the light and shade of color, which may be carried out even in conventional flower patterns. Notice that the coloring is not such as can be represented by the use of raw, crude, solid paint colors. For instance, tone down a strong green with a touch of red, or for stems and vines with a touch of brown or black. Prussian blue should be toned down lightly with lampblack and red, as it is not a good color by itself.

In some instances ordinary one-color stencils (not outline) are filled in with color, using the stencil brush. Then while the stencil plate is still in place, the high

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lights are wiped out and shading is done at the same time.

Two-toned effects, obtained by the use of one color on a lighter colored ground, are interesting and easily produced by wiping out the color from the center or other portion of a pattern to be high-lighted. . Another way to accomplish this effect will be stated.

Frequently there is occasion to use the narrow stencil borders, which we technically call *dividers*, and these are generally applied in one solid color, without any attempt at a more elaborate treatment. This method has the virtue of greater simplicity, requiring less labor, and, therefore, less cost—dominant factors with most painters to-day. And yet we sometimes feel the need of a treatment that is a little different; the need of something that will relieve the monotony or harshness which the use of a solid color generally entails.

On such occasions we may decide on the use of a second color for a part of the design, perhaps shading a portion of it. But a method that is even more suitable for this class of ornament is to use one or other of the various glaze colors, and by strengthening the shading, according to the subject, secure a two-tone effect that will harmonize with the background, and blend with the decorative scheme as a whole.

Two-tone effects are easily obtained after a little practice, and are particularly suitable for the majority of the narrow border designs that are in general use. The most successful results are obtained by selecting patterns that are bold and yet simple, and it should be the object to arrange the shading so as to strengthen and emphasize the features, thereby bringing out the full character of the design.

Treatment of a Border.—Plate 22 illustrates the suggested treatment of a small pond-lily border, and it is particularly suitable as a practice illustration, as it is

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both simple and effective. As a test of this method, try this, or a similar pattern, on a background that is painted a cream color or a light stone. Mix a small quantity of burnt umber, ground in oil, with a little turpentine and dryers, taking care that the color is of a reasonably thick consistency.

Keep an old sash tool on hand to supply this color as desired on to a piece of board, as it is advisable to charge the stencil brush in this manner, instead of dipping it into the color can, in order to avoid having an excess of color on the brush.

Place the stencil plate on an old sheet of paper, and, using a small stencil brush, work a *small* quantity of color all over the pattern, in the same manner as you would stencil the pattern solidly on the wall. This gives a certain amount of color on the edges of the design in the plate, so, after pinning the plate in position on the wall, take a large *dry* stencil brush and commence pouncing all over the pattern, using only the color that adheres to the plate, and which the dry stencil brush will distribute in a light tone. Now take the small stencil brush, and, with a little of the color which was spread on the board, begin

shading the pattern by working from the parts of the design that your fancy tells you should be darkest, until you blend into the lighter color where you wish your high-light to remain.

After completing each length the plate should be moved on a stretch and the process repeated, the small stencil brush that is used for shading being the only one that is charged with color. The dry brush should be used only to distribute the color that adheres to the plate from the shading of the former stretch, and this distribution of a limited amount of a glaze color gives a light, semi-transparent tone that is very suitable for a high-light and which is sufficiently emphasized by the stronger shading tone. This design is quite effective also when

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treated in its natural colors, dull green and soft yellow, characteristics of the pond lily.

WHERE TO USE STENCILS

To Apparently Change the Size of a Room.—It has long been the practice of decorators to place stencil designs, picture moulds, cove moulds, chair and plate rails, friezes and colors in such a manner as completely to

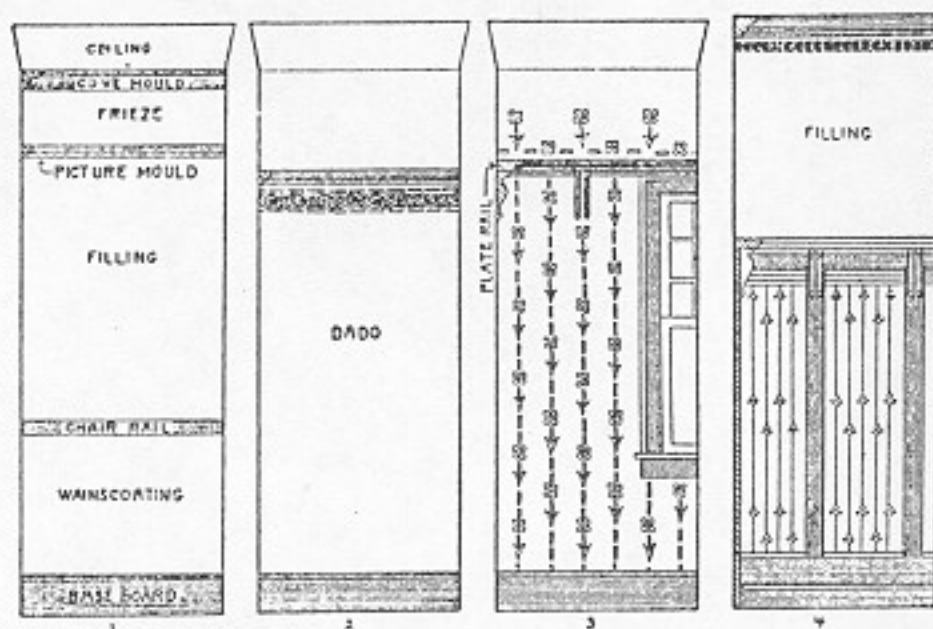


Plate 23.—1, Trade Names for Different Parts of a Room Wall; 2, Position of Dado; 3, 4, Examples of Vertical Stencilling.

transform the appearance of a room. Stencil location, design, and color may readily be used to modify or to accentuate certain architectural features, to direct attention to or divert it from defects. See Plates 23, 24, 25, and 26.

Wall Space Trade Names.—For convenience in designating different spaces in a room, walls have generally been divided into sections and designated as wainscoting, filling, frieze, and dado. See Plate 23.

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Stencil Placing in Small Rooms—Low Ceilings.—The essentials are to decorate walls and ceilings in plain, light tints or delicate Tiffany glaze,—use narrow moulds, and simple, open-pattern stencils, softly colored.

Place stencil, picture mould or a narrow cove mould at top of the wall where it joins the ceiling. Allow no frieze if a bedroom or living room. Figure 6, Plate 24.

In dining rooms where the wood trim is painted or

enameled white, light gray, or ivory, a plate rail is often placed high, usually on a line with the top of window and door casings. The dado between the plate rail and baseboard should not be paneled off, but rather painted or mottled in a light tint and stenciled vertically, as in Figure 3, Plate 23, or else use wall paper having stripes up and down. When the space above the plate rail in this location is 18 or 20 inches high, an open, lightly designed and colored stencil may be run horizontally, just above the plate rail.

Or place the plate rail one-third of the way down from the ceiling, stencil on an open pattern (with the ceiling tint) from 2 to 4 inches wide, immediately below the picture mould. Fill in the dado with small vertical stencil figures as in Figure 4, Plate 23. Use no chair rail.

In other rooms of these proportions, if stencils are used they should if possible be run vertically from a narrow picture mould at the top of the wall, where it joins the ceiling, down to the baseboard, and it will cause the ceiling to appear higher up and the side wall higher, as in Figure 5, Plate 24. Use neither a frieze nor drop ceiling.

When a ceiling is only moderately low, a lightly-designed, open stencil may well be placed below the picture mould, as in Figure 6, Plate 24.

When the wall is plain and the wood trim is not ornamental either, a stencil is often used decoratively to follow the baseboard and door casings, as in Plate 24.

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In any use of the stencil in small rooms the wall color, ceiling, and stencil tints must all be just as light and soft in tone as possible. The ceiling tint is always appropriate for transferring stencils to the side walls.

Where the wood trim of a room is painted or enameled in a light tint, the picture or cove mould should carry the ceiling tint.

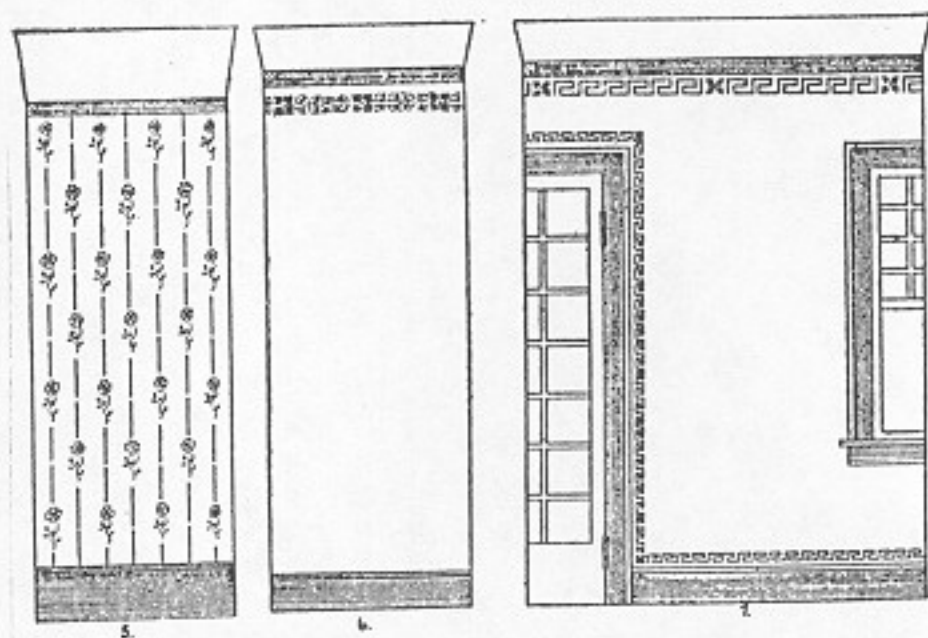


Plate 24.—Stencil Treatment for Small Rooms with Low Ceilings.

When the picture mould is too dark in color, the stencil bold in design or strong in color, the effect of apparently raising the ceiling and increasing the size of the room by vertical stencils and light-tinted or mottled wall colors will be lost, and the reason for it is obvious. The mould or stencil will mark clearly the top of the wall, to show

where it leaves off and the ceiling begins; dark colors on the walls define the limits of the room too clearly, making them seem near, while light-tinted walls appear to be farther away; they do not call attention to their presence as do dark colors.

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Hang pictures with quite long chains or wires from the picture mould.

Painted or enameled woodwork in white, gray, ivory or some such light tint, assists in apparently increasing the size of the room.

Placing Stencils in Small Rooms—High Ceilings.—In such rooms horizontal (not vertical) stencils may be placed, as in Figures 1, 2, Plate 23; 7 on Plate 24; 8, 9,

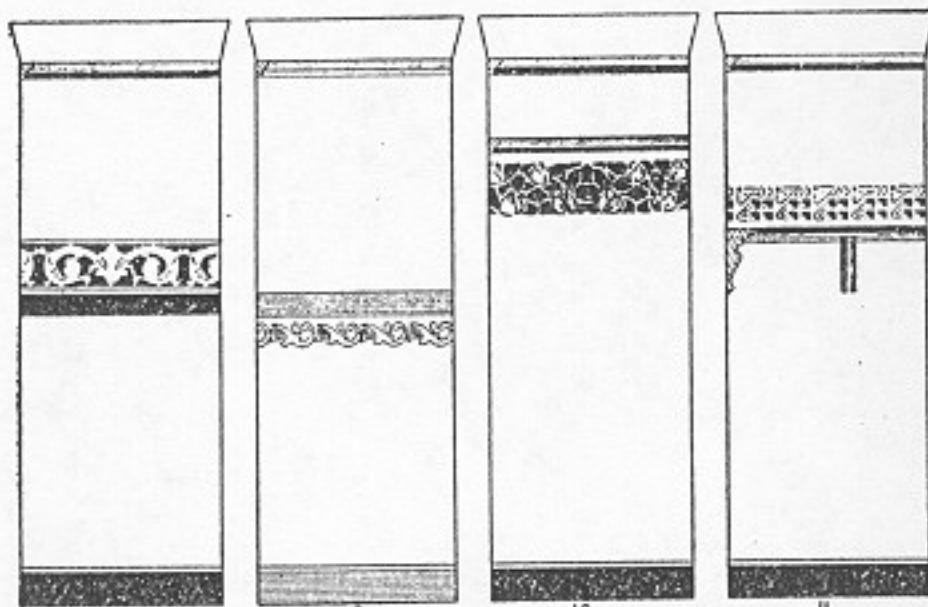


Plate 25.—Stencils Appropriate for Rooms with High Ceilings.

10 and 11, Plate 25. Designs to be open, simple, and of delicate construction.

Dining room stencils are often handled as in Figures 11 and 12, Plates 25 and 26, respectively.

Hang pictures with concealed wires rather than from the picture mould.

Placing Stencils in Large Rooms—High Ceilings.—Large rooms offer an opportunity for a greater variety of stencils, colors, panels and moulds. Arrangements shown in Figures 1, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, and 14, Plates 23 to 26, are appropriate. Some fit rooms bet-

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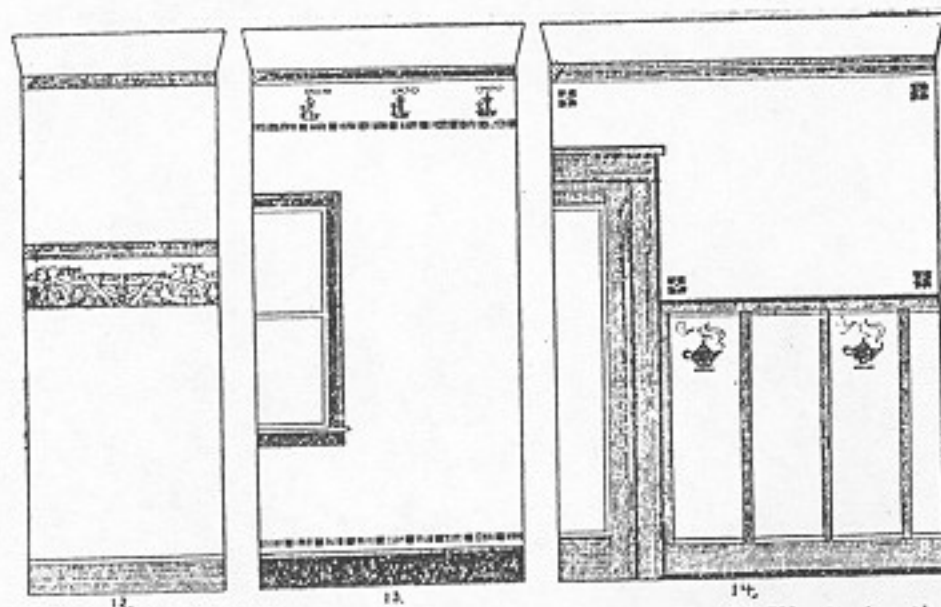


Plate 26.—Appropriate Stencils for Large Rooms; No. 14 Illustrates the Use of a Spot Design.

ter than others. The stencil pattern may be a little bolder in design and colors a little stronger, while the walls may be tinted or glazed fairly dark. This does not, of course, mean that suitable decorations can be secured by using real dark wall colors, by making too free use of stencils on the walls, or by vivid, brilliant colors in large quantities.

Placing Stencils in Large Rooms—Low Ceilings.—Stencil placing, design, and coloring ought to be virtually the same as for other rooms with low ceilings. Wall tints may be a trifle darker than in rooms that are small in addition to having a low ceiling. The same principle is involved as was mentioned before. Light-tinted walls and ceilings appear to be farther away than those painted in fairly dark shades. In large rooms, nothing will be lost by having walls fairly well defined by color, as they will *in fact* be far enough away. It is possible even in a large room to make the walls so dark in color, the stencil design so bold, and color so strong, that the walls

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will seem very near at hand and cause the room to appear crowded. Paneling is more suitable for large and fairly large rooms than for small ones.

In selecting your wall colors, ceiling tint, stencils, and stencil colors, as well as in placing of picture moulds, plate rails, chair rails, etc., the object to be gained in such a room is to apparently raise the ceiling by making it extremely light in color; and by using vertical rather than horizontal stencils on the side walls, which latter tend to lower the ceiling in appearance.

Placing Stencils With Extremely Plain Wood Trim and Walls.—Assuming that the proportions and size of the room are not to be apparently altered, the use of stencils in such a room is solely for ornament. In design they may be more decorative and elaborate than in other rooms, and may be repeated more often. The stencil pattern, as well as colors, should be allowed to be more prominent, even to the extent of drawing a little attention to themselves. Stencil patterns should never be real bold or the colors what might be called vivid or brilliant. Vivid colors may not be used anywhere except in small areas. A very small quantity of bright color is sufficient to balance a large area of soft, dull tints. The wall color should be quite a light tint, and the ceiling should be very light.

Placing Stencils Where the Wood Trim Is Fancy and the Walls Are Decorative in Themselves.—Many of the rooms in older houses have heavy moulds, beading and ornamental wood trim, while the ceilings often have relief medallions and are otherwise decorative. Obviously, stencil designs and coloring ought to be very small, simple, and delicate for such rooms. They should be used sparingly and placed judiciously, so as not to add too much decoration to a room that is already quite ornamental in itself. What are often called spot designs, as in Figure 14, Plate 26, are best suited to such rooms.

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CHAPTER VI

SOME GOOD JOBS ILLUSTRATED

Undoubtedly the very best way to become proficient in the use of stencils and colors as a means of decorating rooms in public buildings and private homes, is to study the finished work of other decorators who are capable and experienced. But it is not convenient for a large number of painters to do that, and so the next best opportunity is to study pictures illustrating the work and written descriptions of it.

It must be borne in mind, however, that such descriptions of jobs necessarily omit one of the most important elements—namely, color. And color can make or break almost any scheme of decoration. By all means study the fine stencil jobs to be seen in all cities—the hotels, libraries, restaurants, and the better class of stores—whenever it is possible to do so.

The decoration of a moving picture theater ceiling and a photograph studio, recent jobs done in Chicago by well-known professional decorators, will now be described and illustrated.

PICTURE THEATER CEILING DECORATION

Plates 27 and 28 show pretty well the mechanical appearance of the ceiling stencil decorations of a Chicago theater, but they do not give even a fair conception of the artistic appearance of the finished job, being without the color values.

This job was executed by experienced professional decorators, with mechanical means rather than freehand. Any decorator who can do neat, careful work can pro-

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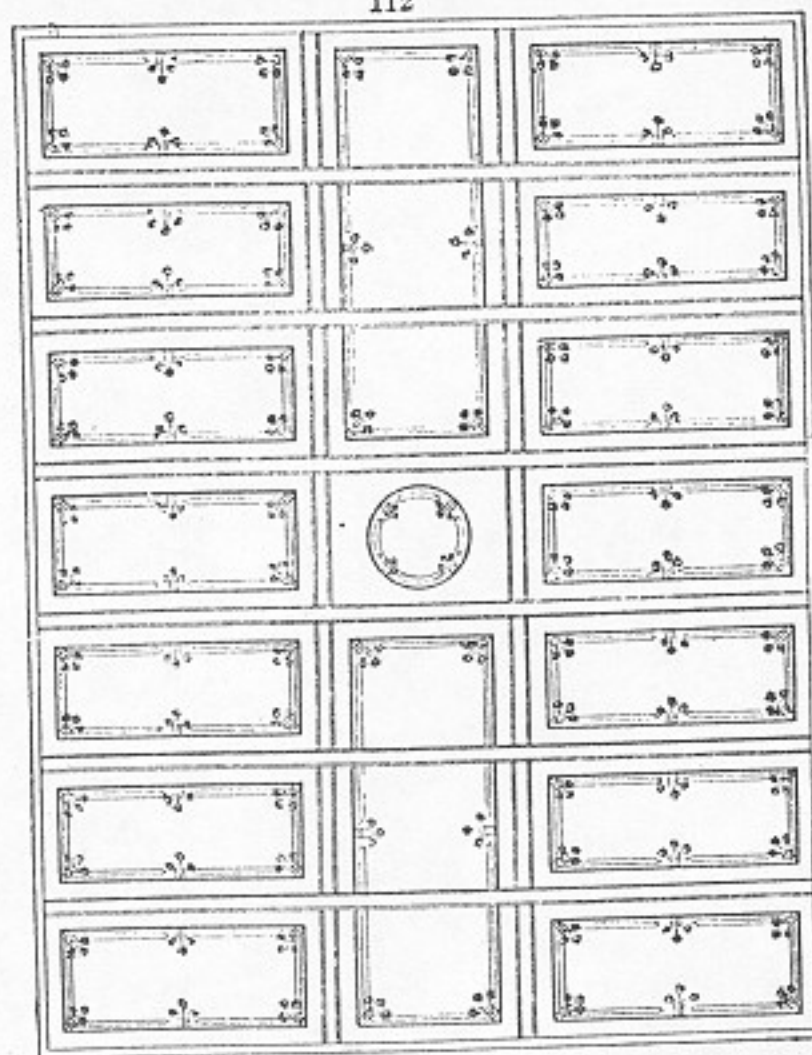


Plate 27.—General Layout of Ceiling Decoration of a Chicago Theater. An Artistic Job, Though the Illustration Does Not Show the Color Values.

duce just as fine results by careful study. The skill in

the execution of this ceiling is not so much shown in the actual work of decorating as in the designing and laying out of the lines and colors.

This really is a very simple, yet charming, piece of work; much more simple, because of the soft, delicate colors used, than the black-and-white drawings indicate.

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Observe that the nice balance and proportion of the whole ceiling could easily have been disturbed by a simple mistake. Suppose a small rectangular border and stencils, like those used in the other panels, had been placed in each of the six small center panels, in place of the two long rectangles used, which apparently run under two of the beams on each side. Would not that have wrecked the success of the treatment? The whole ceiling would have been spotty and confusing to the eye.

Plate 27 shows the general layout of the whole ceiling. Notice that identically the same treatment was given all of the rectangular panels. The center panel has been treated in the same manner, using a circular border in place of the rectangle.

Method of Procedure.—The procedure in executing a job of this kind was about as follows: The beams or trusses of this ceiling had been covered over with plaster ornamental mouldings, as is usual with buildings of this character. Two coats of lead, oil, and turpentine, tinted to light ivory with raw sienna, were brushed on with a size coat of glue or varnish between the two. Of course the second coat was thinned with turps only, so that a flat surface would result. The beams were given no further finishing. If they had been made of natural or stained wood the whole ceiling would have been quite as attractive, treated as it was, but a little different to be sure.

All of the spaces within the beams, the panels, marked *A* and *G* in Plate 28, were then painted two coats and a size to finish with a flat surface. The color for these areas is a warm, light gray, made by tinting white lead with a bit of raw sienna and raw umber.

With the beams and panels finished and dry, the ceiling was measured off and laid out for the lines and stencils. The line *F* was located 16 inches from the beam all around on four sides. Either a chalkline or a brass-

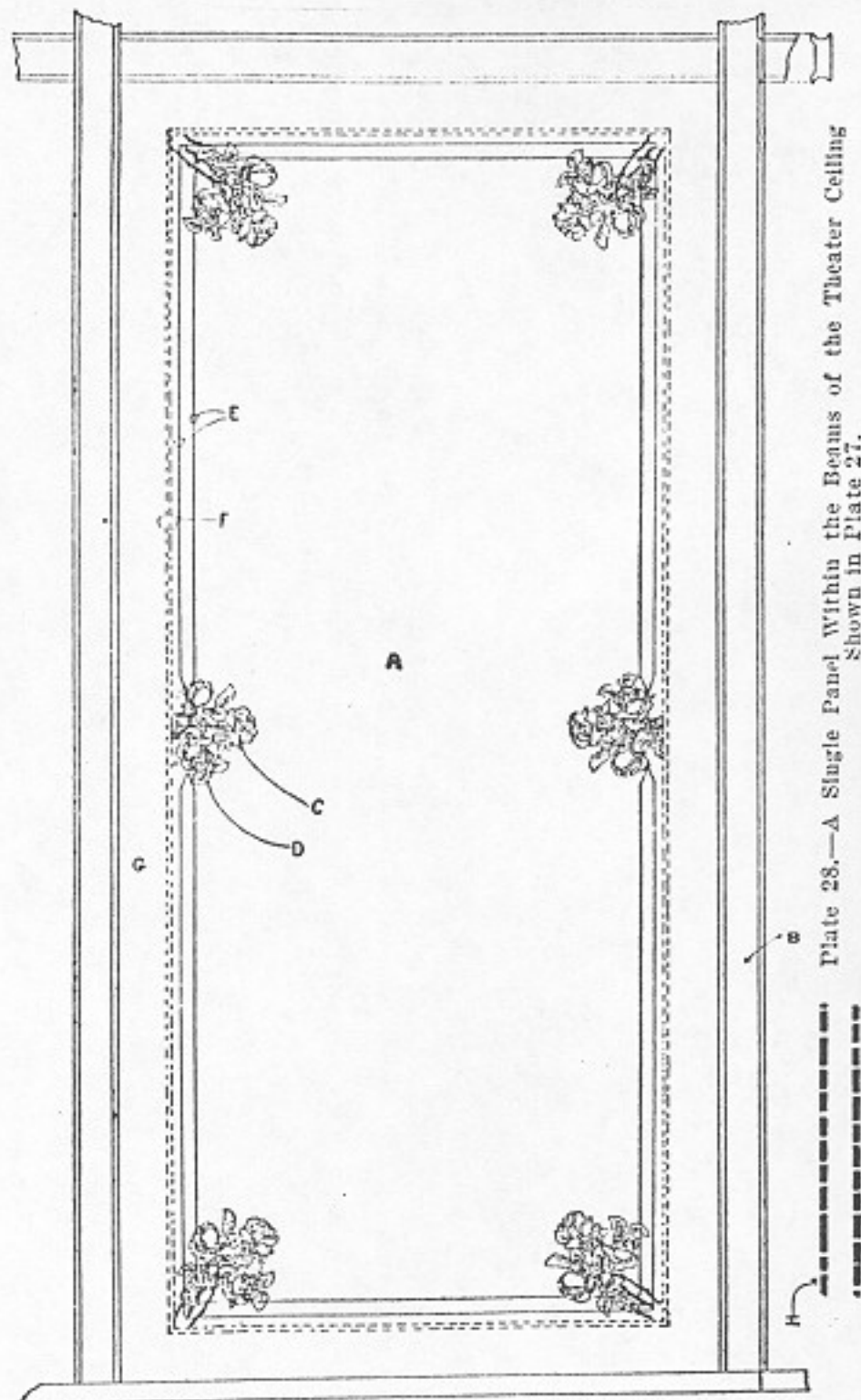
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bound straightedge and a pencil were used to run a temporary line on the wall, to be followed by the stencil.

When a chalkline is used it is first coated well with chalk. Then, being held taut against the measured marks on the ceiling by a man at each end, it is pulled down a few inches in the center and when let go quickly it snaps a straight line onto the ceiling.

Next a stencil was cut to transfer two dotted lines each one-eighth of an inch wide and one inch apart, as shown by *H*, Plate 28. The dotted stencil lines were transferred with burnt umber thinned with turps. The space between these two lines was filled in by hand, using a half-inch fitch. The color was raw sienna, thinned a little with turps and a few drops of linseed oil. This operation made line *F* complete.

Lines *E* are one-half inch wide, solid rather than dotted



stencil lines, and were painted with burnt umber. The lines are four inches apart and two inches from line *F*. An angle lining fitch and a straightedge were the tools used in running these *E* lines, as described in Chapter VIII on Lining. They could also be marked on with a pencil, using a straightedge to keep them true. Then they could be filled in with an ordinary fitch. This would require more time, however, than to line in the regular manner.

Bear in mind that the lines, flowers, leaves, and stems are all painted with the clear colors as they come from the can, and are not mixed with lead. These are semi-transparent colors, which permit the ground color to show through.

The roses, leaves, and stems (*C*, *D*,) were transferred with an outline stencil, as shown in Plate 14, Figure 649. There are many other stencils which would serve quite as well. This one was transferred in raw sienna, which simply made an outline of the flowers, leaves, and stems.

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When the outline was dry the leaves (*D*) and stems

were filled in by hand with a small one-quarter-inch fitch, using chrome green with a little raw umber added. The stems were made a little darker than the leaves. The color was used quite thin.

The flowers (C) were next filled in with a thin, transparent red—rose pink or American vermilion probably—using a small brush as for the leaves and stems. While the red was still wet the color was wiped thin at the edges of some of the flower petals, leaving a lighter pink. A cloth wrapped over the thumb or forefinger is used for wiping out these high-lights and shading, as a rule. The end of a small brush or pencil may be used, wrapped in cloth, for small parts.

When stenciling on residence walls and others to be seen in daylight and bright light, the colors must be kept soft and delicate. On this theater ceiling, however, which is seldom seen except with dim electric lights, the colors were necessarily made fairly strong, so as to carry well in the dark. Observed in bright light, the stenciled flowers and leaves appear rough, crude, and altogether too strongly colored. As with oil painting, bulletin and scene painting, stencils must be colored only bright enough to give a soft, delicate effect at the proper distance from which they are regularly seen, and with the regular light.

A PHOTOGRAPH STUDIO DECORATION

By carefully going over Plates 29, 30, and 31, you should get a pretty fair idea of how the stenciling was carried out to decorate one of the best studios in Chicago. These drawings, limited to black and white as they are, do not give a good idea as to color values, nor yet the attractiveness which the colors add. In Plate 29, for instance, the stencils *D* and *E*, shown in black on the drawing, are entirely too strong in contrast with the

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white wall *A*. Likewise the ceiling, Plate 31, does not appear in the drawing to be nearly as attractive as it really is, because the stencils *F* and *H* contrast too strongly in the drawing with the white ceiling *J*.

This studio is on the ground floor of an ordinary store building and is in proportion rather too long for its width, and the ceiling is a trifle too high. One not looking for these details would likely not notice them, because the decorator with his deep stencils and the architect who

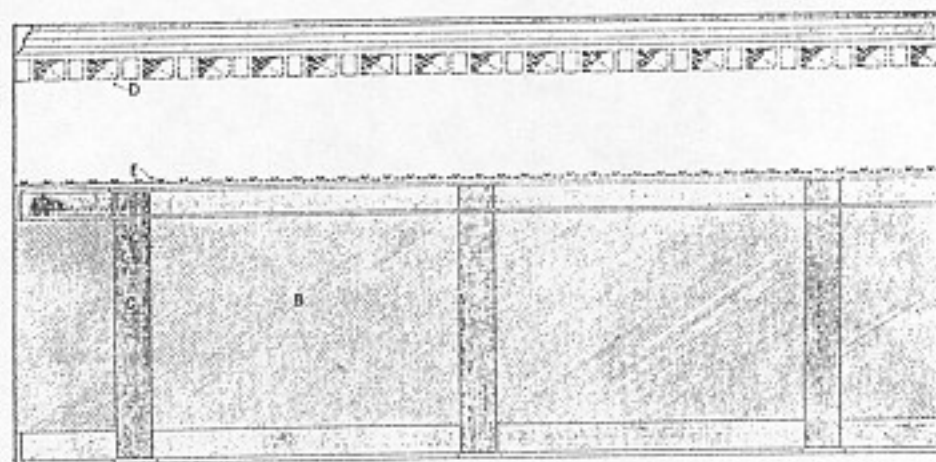


Plate 29.—Decoration of a Chicago Photograph Studio.

planned the deep cornice and high wall panels have pro-

duced a very attractive interior.

The cornice, mouldings, base board, the stiles of the wall panels, and all other wood trim are of red gum, varnished and pumice rubbed, after a very light application of thin brown stain. It appears very much like walnut, and probably is thought to be such by most people. It is possible that the gum was not stained at all. That wood, when finished naturally with varnish only, is a medium dark brown, and after two or three years turns much darker, like most trim lumber.

The filling or upper side wall *A*, Plate 29, is a rough sand finish. The panels *B* are of coarse weave wall can-

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WALL STENCIL



CEILING STENCIL



WALL AND CEILING STENCIL

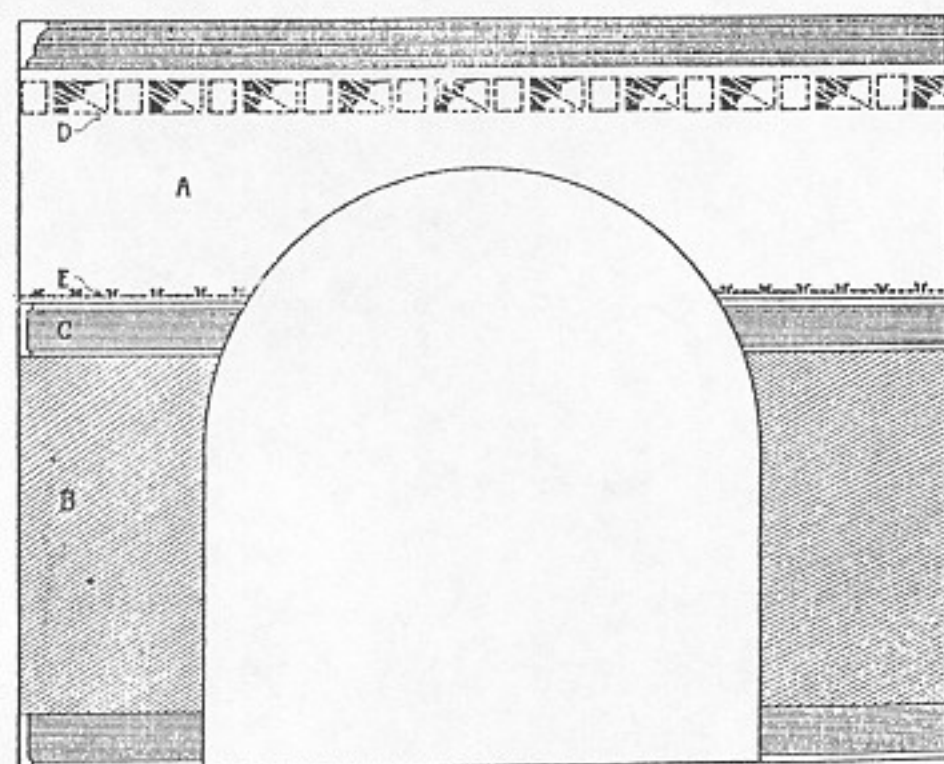


Plate 30.—Stencils Used in Decorating Rear Wall and Ceiling of Studio.

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was, decorated with a Vandyke brown or burnt umber glaze, nicely mottled or stippled out with a wad of cheese cloth. This transparent glaze stain was put on over an opaque flat cream ground (white lead tinted with raw sienna).

The filling *A* was glazed with the same brown stain color used on *B*, but over a much lighter cream or ivory ground color. *A* is several shades lighter in color than *B*.

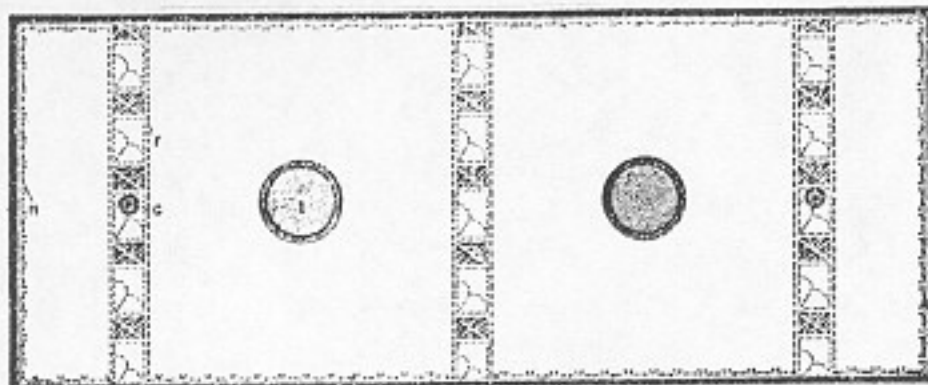


Plate 31.—Layout of Studio Ceiling Decoration.

The stencils *D* and *E* were transferred with the Vandyke brown or burnt umber, and are not very strongly in contrast with the mottled color of *A*.

Plate 30 shows the handling of the rear wall of the room, which separates a small workroom in the rear from the main display room. Obviously the decoration was handled the same as in Plate 29. Plate 30 also shows large-size reproductions of the stencils.

In Plate 31 is shown the ceiling layout. The cornice at the top of the side wall, of course, forms a brown frame around the entire ceiling, as indicated by the wide black line. The ceiling color is the flat light cream or ivory, whichever you choose to call it, which was used as the ground coat on the filling *A*.

The stencil *F*, which you will note is the reverse of

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stencil *D* on the wall, is transferred in a soft, light blue (white tinted with cobalt blue) about a sky-blue shade.

Stencil *H* is the same as was used on the wall above the wainscoting and is used on the ceiling in the same color also—dark brown.

G on Plate 31 indicates the light chandeliers, and *I* the ventilators.

SOME PANEL IDEAS

Writing on the subject of adapting certain stencil designs to artistically decorate different rooms, Reginald Ware, in "The Canadian Painter" has presented some valuable ideas for the use of detached designs.

A style of decoration that can be obtained by a slight alteration of the laurel-leaf design in shown in Plate 32, Figure 1. This is worthy of a little consideration, not only because of the excellent decorative results to be secured by its application on a suitable background, but also because it affords us a simple illustration of the adaptability of certain designs.

Much might well be written and illustrated on this subject that would prove of great benefit to the beginner, as it is a study worthy of the careful attention of every decorator, and a necessary acquisition to the ability of those responsible for the arranging of the interior decorations of churches and other large public buildings, where the harmony of the types of design used are second in importance only to the harmony of the color scheme of the decorations as a whole.

Utilizing Old Stencils.—We can profitably spend some time in carefully looking over our old stock of stencil plates and designs, and noting how, by minor alterations,

we can adapt portions of certain patterns so that they enable us to obtain decorative effects totally different, perhaps, from that for which they were originally intended. The beginner, no matter how limited his pre-

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Figure 3.



Figure 2.

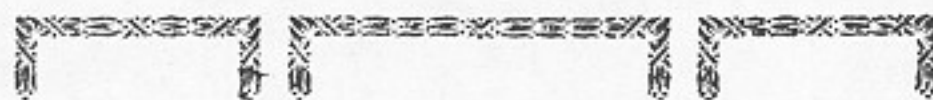


Figure 1.



Plate 32.—"Suggestive Paneling" for Decoration of an Upper Wall Space.

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vious experience, would be well advised to devote some time in this manner, as by thus educating himself to the useful possibilities of the different motifs, and by building from parts complete patterns to suit his fancy, he will acquire the ability to complete different arrangements of the same motif, suitable for the different size spaces of the larger buildings, when he undertakes this class of work.

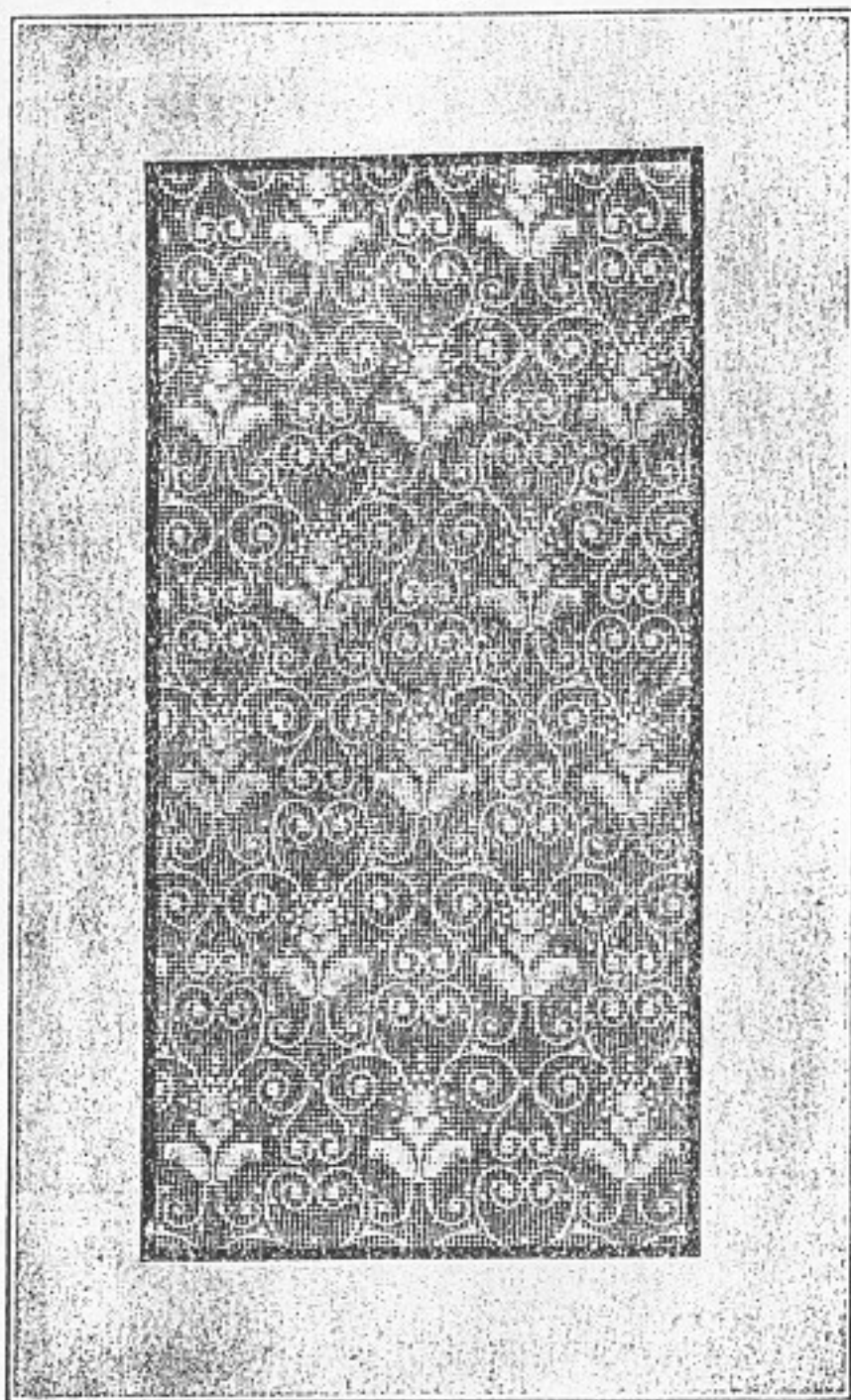
Unsuitable Designs.—Many elaborately executed interior decorations are seriously marred from an artistic standpoint by the inclusion of unsuitable patterns as parts of the ornaments, the effect appearing just as objectionable to the true artist as a serious clash of coloring would to the average eye.

In one of our big cities the interior decorations of two prominent churches are glaring examples of the lack of appreciation—or shall I say "interpretation"?—of their

requirements by their decorators. One, an Oriental type of building with a large central dome, contains an assortment of ornaments, chiefly of the Gothic and Tudor period, that are entirely out of place. Scarcely a section of the designs used is in keeping with the architecture of the building, which should have been treated more sympathetically with suitable Oriental designs. The second church shows the effect of a too elaborate treatment, as the interior appears to contain one large assembly of stenciled patterns on ceilings and walls, with scarcely a portion of the background visible. The impression created in the mind of the average person is that the decorators accidentally omitted stenciling the floors and pews.

When engaged in domestic work, there is not the same danger of the clashing of the types of designs, as it is seldom that two distinct motifs are needed in the same room or hall, yet it is essential that a pattern suitable

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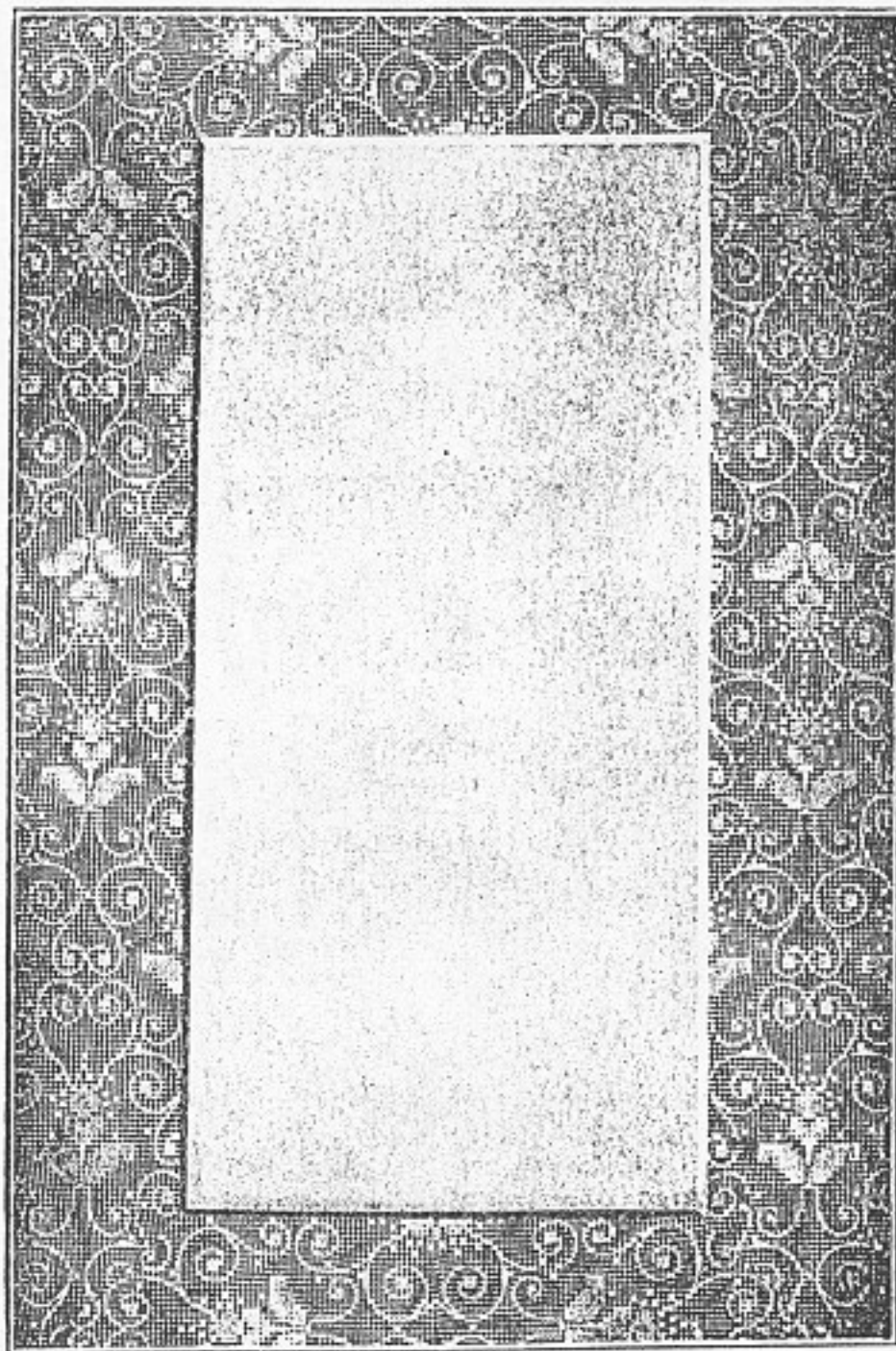
A Lace-Curtain Stencil Transferred in a Moderately Dark Color onto a Light-Colored Ground Coat.

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to the features of its surroundings be selected, and that a too elaborate treatment be avoided.

Suggestive Paneling.—One of the illustrations shown

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Another Lace-Curtain Stencil Design Suitable for Wall Panels.

in Plate 32 is a modification of the panel effect and might be termed "suggestive paneling," as it is a compromise between the ordinary band-border and panel decorations, with a very decided suggestion of the latter. It is suitable for the decoration of an upper wall space, and its use can be recommended where the heavier panel effects are not desired. The illustration conveys an idea of the suggested arrangement. In this instance the larger panel is central.

The lower part of Figure 1, Plate 32, resembles a broken band-border effect, and is suitable alone as a decoration beneath the moulding or cornice of a living-room or reception room. When applied on a blended background (whether the latter be painted or covered with an oil-coated wallpaper) the results are good, as it gives just that suggestion of ornament necessary for this type of room, without the harshness of a continuous, narrow band-border.

To secure a good effect in the average room, the top of the design should be kept a few inches below the top of the side wall, parallel to the base of the cornice or moulding. Having struck a chalk line around the room

at the distance suggested, we find the center length of this line on the main wall, and stencil our center pattern. After marking off the approximate distance from each side, where our large central section shall end, we complete the stenciling of this section from both sides of our center pattern, arranging so that our respective ends shall finish with an unbroken leaf at the point where this occurs, nearest to our "approximate" marks. This gives us our central section completed. From the extreme ends of this section we next find the center of the distance to the angles, and stencil our centers of the shorter sections.

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From these centers we stencil our patterns toward the middle section, again finishing at an unbroken leaf when within a few inches of the ends of our central length. By continuing a similar distance towards the angles we have our short section finished.

This is repeated on the opposite wall, but on the narrower sides of the room, where, perhaps, only two sections of pattern are required, we first find the center from corner to corner, which in this case becomes the center of the center "stile." From this center we measure a small distance each way, equal to half the distance of the division between sections on our main wall. From each angle towards the center we measure the full distance of the "stile," and within these marks again have the approximate length of our sections. By working from the center of these sections and finishing at an unbroken leaf as before, we are able to complete the decorations on these walls.

To secure the best results the use of at least two different colors are necessary, and on the blended backgrounds a soft two-tone effect for the leaves can be recommended. The illustrations shown are in one solid color. This was done for the sake of "clearness" when reproducing, and because of the large reductions of the proportions necessary to include the complete sections in the plates.

Maple-Leaf Effects.—Many pleasing decorative effects can be obtained by various arrangements of the maple leaves as the motif of the ornament. Some suggestions are illustrated in Figures 2 and 3, Plate 32. No. 2 shows an adaptation suitable for the crown or top of a panel, the narrow border being continued down the sides. The width of the panels can be enlarged by extending the extreme leaves of the former pattern, as shown in the center section of the portion of paneling illustrated in Figure 3.

When using the perpendicular border, illustrated in

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Figure 3, it is not necessary to attempt to turn the bottom corner of panels and continue along the base. Instead a finish should be secured at a leaf when within a suitable distance from the base, thereby securing a suggestion of paneling that will look quite as effective as the completed panels.

By using the crown section of ornament only, another style of decoration may be obtained, suitable for the same class of room as suggested for the lower part of Figure 1. This decoration also should be kept a few inches below the base of the cornice or moulding, and the side leaves

extended to suit the space to be occupied by the design. In a room where the chimney breast projects, and the main wall is thereby divided into three sections, it is particularly appropriate.

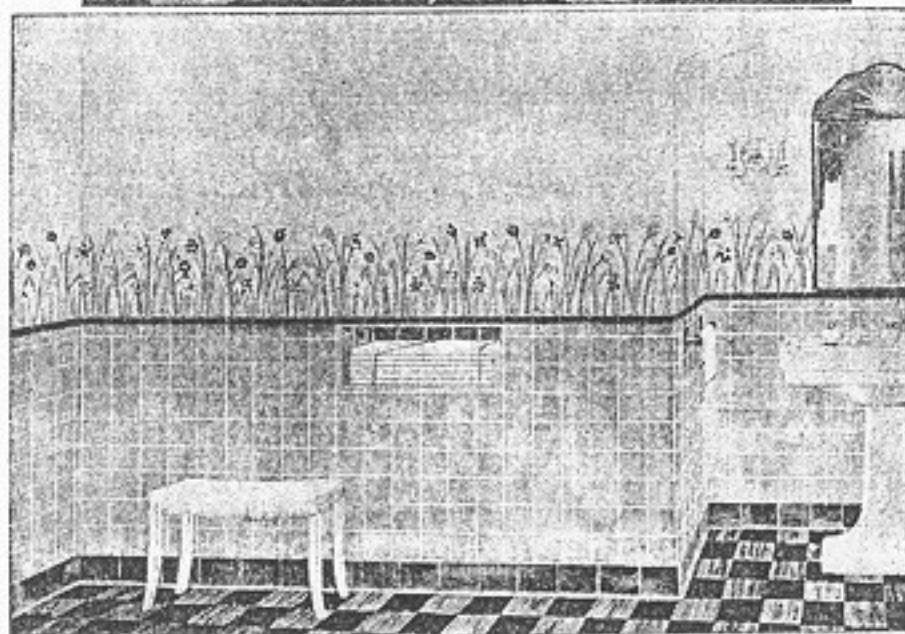
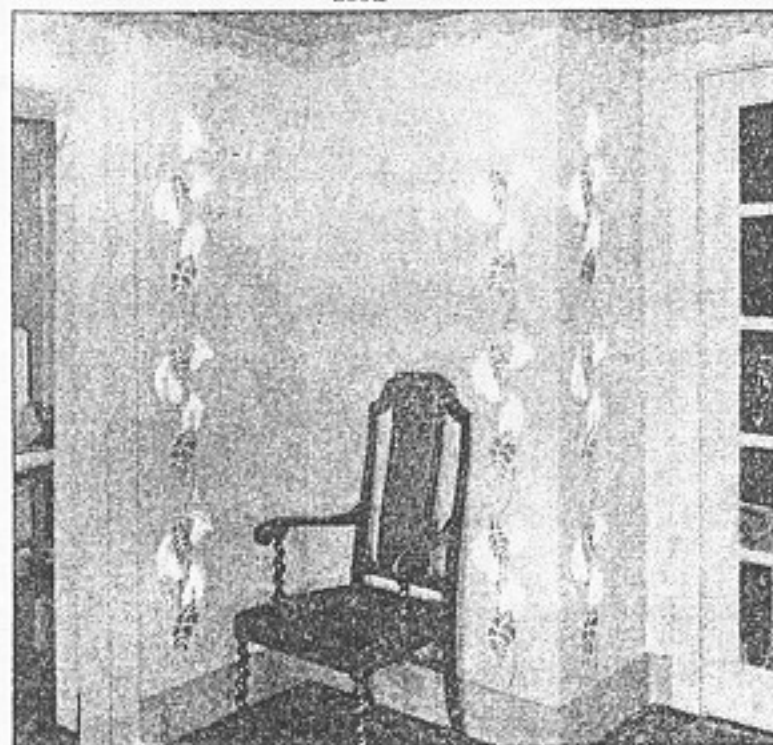
On several pages following are shown some of the newest of contemporary stencil designs used in a new way. A few notes about the style trend in stencil decoration may also be helpful.

There is greater use now of spot or detached designs. For example, on cupboard doors of kitchens such designs appear; also on doors of closet and wardrobe, inside or outside, tall vertical designs of the leaf and vine type, trees, or geometric and conventionalized forms applied to brightly colored grounds add much to the rooms. The tall, vertical designs also are much used alongside of door and window casings and on wall corners.

Another style trend is in the use of drop ceilings in dark colors:—the ceiling color is painted down on the walls from four to ten inches and finished off with a stencil.

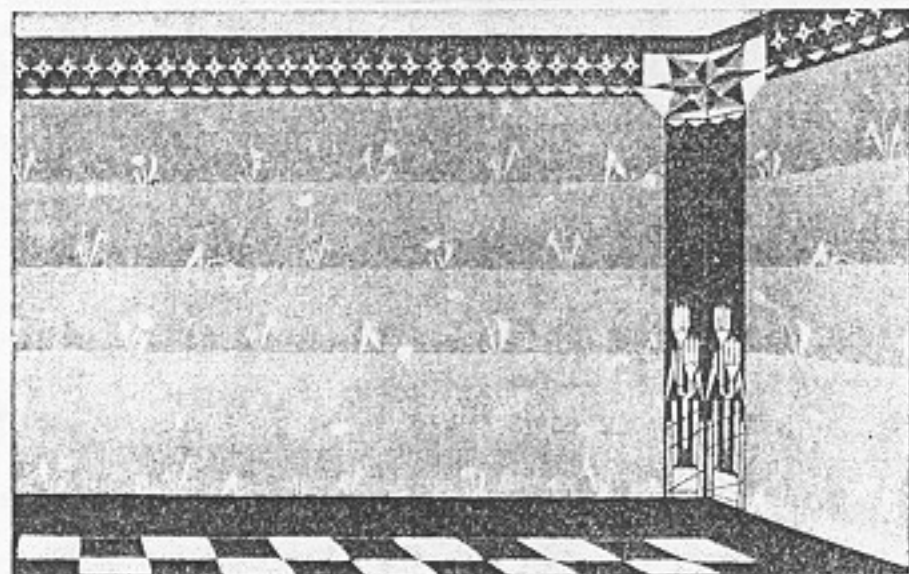
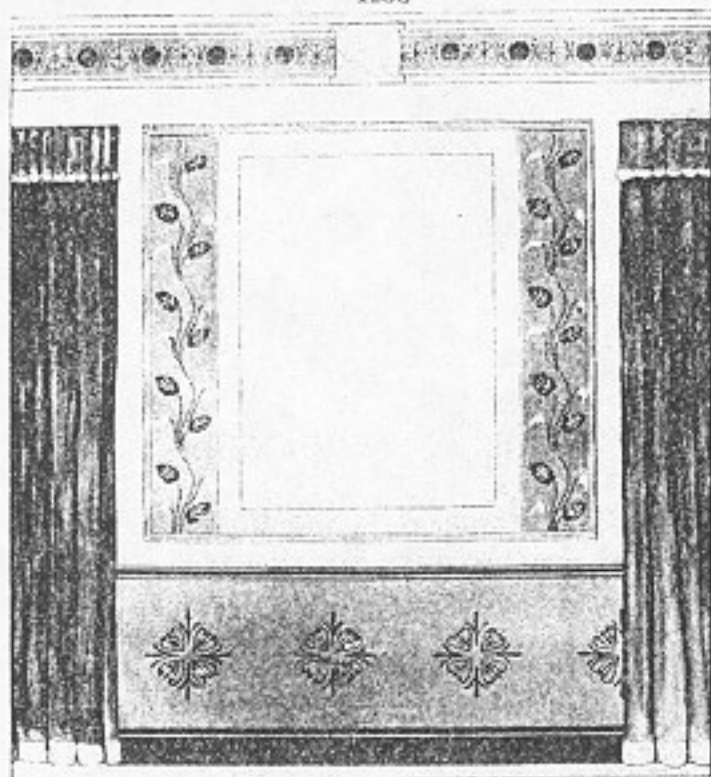
Large flower patterns are delightfully used now on only one of the four walls of bed rooms, for example, to form a panel at the head of the bed; the other walls being painted in plain color.

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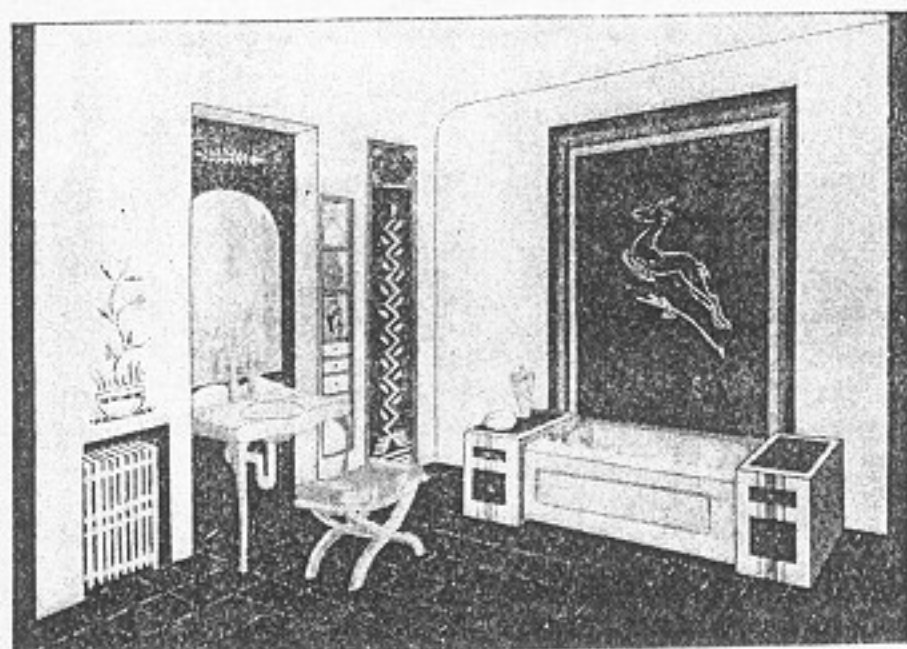


Duplicate Pages 125 a, b, c, and d, are included to clarify the Illustrations

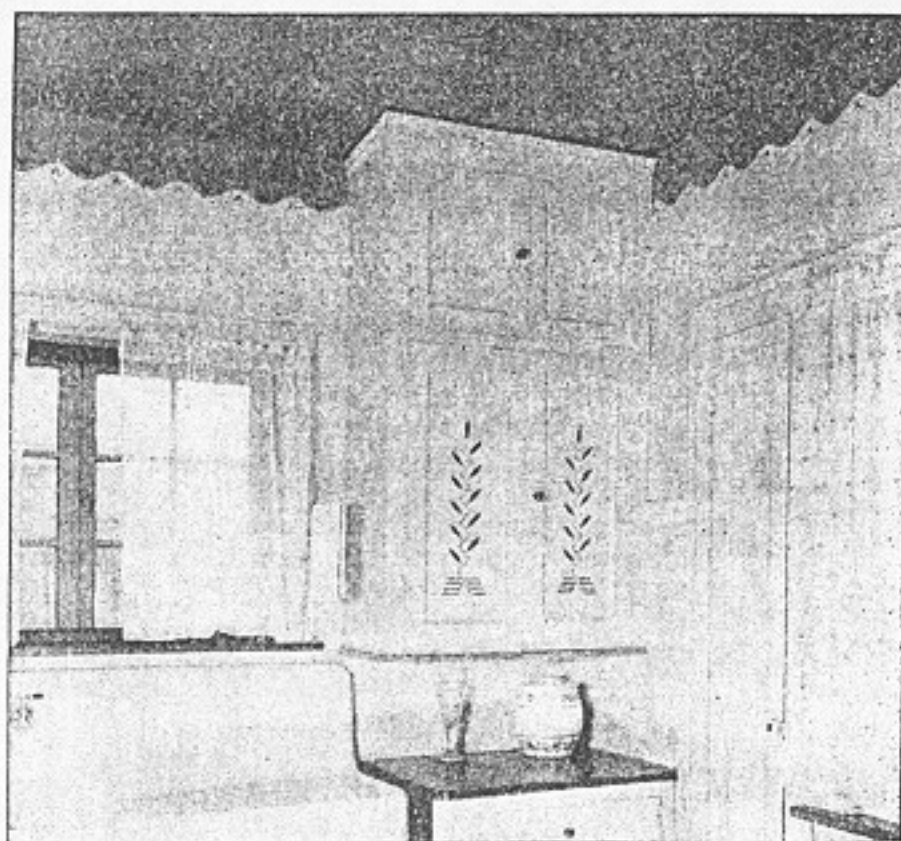
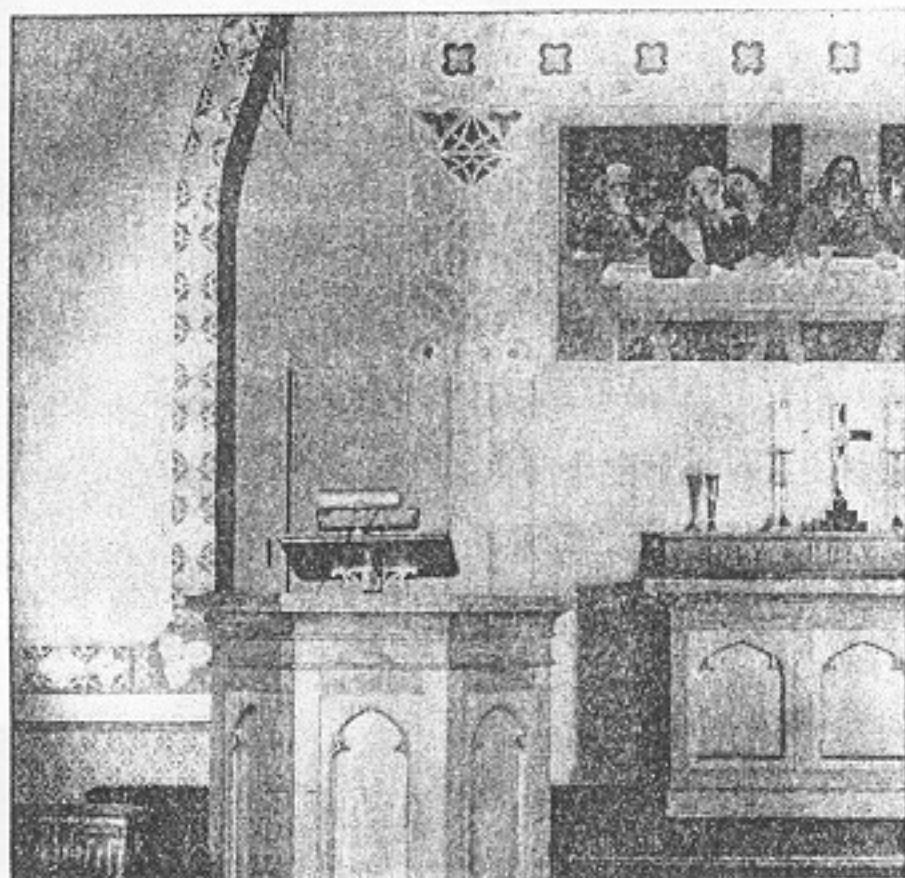
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CHAPTER VII

CEILING, FLOOR AND FABRIC STENCILING

Many ceilings of rooms in our homes are the better in appearance for not having any ornamentation whatever placed upon them. There are ceilings in living rooms and libraries, however, which might well be given a very

light and simple treatment, both in color and design, which would add materially to the effect of the room as a whole.

The use of detached motifs, or spot designs, is most effective for ceilings, because of their simplicity and adaptability. They can be used often when more solid, continuous stencil designs on a ceiling give an impression of its being over-decorated.

Selection of Ceiling Color.—Colors for ceiling use may consist of any which will be in harmony with the general color treatment of the room, but they must be very light and airy. Dark colors cause the ceiling to appear too low. The light-blue sky tint is suitable in some instances, but at other times the very light yellowish and grayish whites are needed. When the ceiling is high up, and when usually seen in darkened rooms, as with theaters, the color must be stronger than for low-down residence ceilings. The effect of artificial light on colors is also a necessary consideration; blue, you will remember, is only barely visible at night, yellow is not strong, and most other colors are changed more or less by night lighting.

Drawings Should be Made.—Before attempting to decorate a ceiling, make a drawing of it on paper to scale, so that your proportions are correct. Then figure out the

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best location of your stencil designs, lines, and colors. Mark your drawing to show in inches the exact position of every line and every setting of the stencil. It is much easier to figure these things out on paper, seated at a desk, than to lay out and judge distances, balance, proportion, and so on with the head bent over in a neck-breaking position while you try the stencil and lines on the ceiling by the "cut and fit" method.

With the scheme of design all laid out on paper and the measurements marked, the next step is to mark off the ceiling with chalk (never pencil), to locate the position of each setting of the stencil and each line. A three-foot flat rule, straightedge, and a chalkline will enable you to lay out the work quickly. Snap the long, straight lines on with the chalkline. The chalk will rub off when the job is finished.

If the decorative scheme looked well proportioned on the paper drawing laid out to scale, it will look well on the ceiling, put on to correct measurements, so you will not be required to spend any time wondering how the design will look while doing the actual work on the ceiling.

Transferring the Stencil.—It is not so easy to stencil on ceilings as on walls. For that reason one ought to take advantage of every little help and short cut. For large and high ceilings scaffolding built up high, so that one can lie down on it and face the ceiling while transferring the stencil impression, helps to make it easier and saves time. The stencils ought to be made of heavier paper than for side walls, and may be fastened with glass push pins.

Sometimes many repeats of the stencil are cut through a strip of stencil paper ten or twelve feet long, to save moving a short stencil plate so many times.

Certain kinds of stencils may be transferred with a paperhanger's rubber roller instead of a brush. A piece

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of long-nap plush is sewed on to completely cover the roller. The color is brushed on to a board. From there it is picked up by the roller and transferred to the wall through the stencil plate.

Whatever the method it is not so easy to transfer a clean, sharp impression to a ceiling by means of stencil plates, so don't be discouraged if it becomes necessary to wash off a stretch or two with benzine, and begin all over again.

The straight lines so often used for connecting detached spot stencil designs are usually run on with an angle liner (a brush), when smaller than one inch wide. See Chapter VIII, about Lining. Lines one inch and over may be stenciled on; that is, an outline stencil is cut, which simply consists of two parallel lines one inch apart or whatever width is wanted. Ties are left in cutting the stencil and so the lines are disconnected. The space between the lines is filled in with semi-transparent glaze color, using an ordinary fitch. Just how far the lines should be placed from the edge of the ceiling depends on the size of the room and the massiveness or delicacy of the wood trim.

Designs for Ceilings.—The kind of stencils usually found suited to ceiling decoration are the spot designs shown in Plates 28 and 11 and continuous patterns of the character shown in Plates 31 and 1. Of course, any designs which seem to fit and look well may be used with good effect.

Just how a ceiling should be laid off in panels, or treated without them, depends on many things,—the architecture of the room, cornices, mouldings, beams, and other features. Plates 27, 28 and 31 will illustrate how some ceilings have been well decorated. There are about as many styles with more or less merit as there are decorators.

Often where a ceiling or panel is small and is sur-

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rounded by moulding, it is much better to place the stencil ornament only in the four corners, with very light lines or no lines connecting them. The temptation to place a fifth spot in the center of the ceiling must be resisted. When a fifth spot is used, make it larger and somewhat different, so as to form a centerpiece.

FLOOR STENCILING

The stenciling of floors does not offer a very wide opportunity for business, but still one ought to keep in mind that it is sometimes done with good effect. There are jobs upon which it is desired to do "something different," either for the novelty of it or because the conditions are different.

Many houses still have the old-fashioned soft-wood floors, and they offer a painter an opportunity to create some new business. Rugs have displaced carpets almost altogether, and they do not look well unless the floor is well finished. The cost of replacing these old floors with hardwood is considerable, and as satisfactory re-

sults can be attained by using the new method of finishing floors, the difference in cost makes it attractive to the average house-owner.

Briefly, the method is to paint the floors, then decorate them by separating the border from the center by plain strips or stencil designs. The color of the border and center may be different shades of the same color, the idea being to produce the effect of a rug sometimes, but more often merely to run a stencil border around the edge of the floor, a real rug being used in the center. Bedroom floors are most often decorated in this manner, although an old floor in any room can be made much more presentable.

Preparation.—To begin with, scrub the floor and give it time to dry out well. Cracks must be free from dust and dirt before a filler will stay in place.

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Fill small cracks with putty, made from two-thirds whiting and one-third white lead, linseed oil, and floor or rubbing varnish. Fill large cracks with putty made by mixing whiting and fine sawdust with water, to which has been added enough glue to make it stick. Cracks in new lumber should have a coat of oil first.

When the filler is hard, sandpaper the floor smooth, cutting down with a plane any edges of boards that are warped.

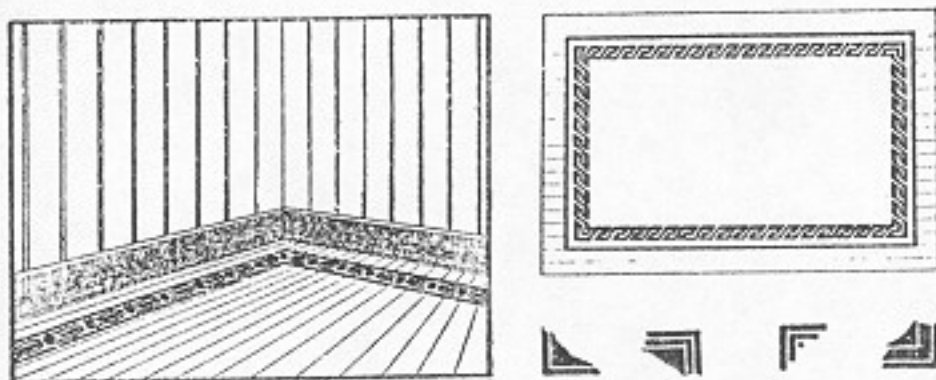


Plate 33.—Common Methods of Striping Floors.

First Coat.—Thin white lead with one-third turpentine and two-thirds linseed oil. Add about a tablespoonful of drier to the gallon of paint if raw oil is used, and tint to suit.

Second Coat.—Mix white lead with raw linseed oil. Put in the drier and add some floor varnish to make the paint tough; one-half to one pint of varnish to the gallon of paint will serve the purpose. After your floor has become dry and hard, it is ready to stencil or stripe.

Striping.—Plate 33 shows the common methods of striping, although these may be varied by making the stripes any width desired or by using several narrow stripes. The lines are laid out with a straightedge, rule, and pencil and should be at an equal distance from the

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baseboard all around the room, disregarding small offsets.

Stenciling.—Stencils most appropriate for floors are those of simple, strong design. The Greek key design is perhaps most frequently used. The width of the stencil or lines used will be governed by the size of the room.

A stencil 4 to 6 inches wide will be most useful, although there are places where 2 and 3-inch stencils are needed, and some where 8 or 10-inch patterns can be used. You will have to do a little scheming to select just the right stencil or method of striping to fit each room. Plates 1, 7, and 33 show suitable stencil designs.

First lay out the floor with a chalk mark as for striping, so that you will be sure to get the stencil straight. Use thumb tacks to hold the stencil in place while transferring it.

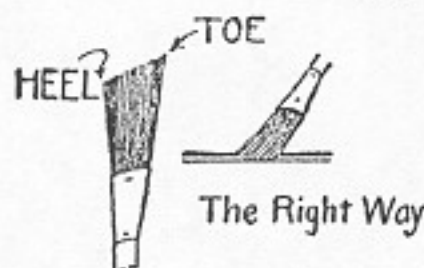
Ordinary tinting colors ground in oil are used for transferring stencils. Thin with turpentine two-thirds, and linseed oil one-third, to a thick brushing consistency. A stencil brush is required for putting on the color, and should be well wiped out on a board after dipping it into the color and before putting it on to the stencils. Or, better yet, do not dip the brush in the paint; spread the paint on a board with another brush, then pick it up on the stencil brush from the board. The brush must be used almost dry, to avoid runs in the stencil and ragged edges.

For this stenciling and lining work you will require several small brushes from 1 to 3 inches. Probably $\frac{1}{4}$ and $\frac{1}{2}$ -inch angular fresco liners would be useful also.

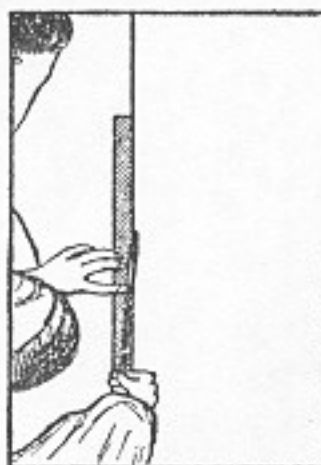
Colors.—Select the floor or ground color to harmonize with the wall and woodwork colors, but make it a little darker than the wall.

Stencils and lines should be put on in colors that harmonize with the floor, and contrast not too strongly. The center portion of the floor may be the same color as the

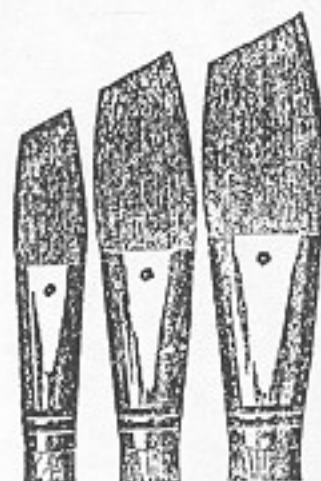
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"By courtesy of Mr. G. N. Malm, author of 'Treatment of Walls and Ceilings' published by Acme White Lead and Color Works, Detroit, Mich."



"By courtesy of Mr. G. N. Malm, author of 'Treatment of Walls and Ceilings' published by Acme White Lead and Color Works, Detroit, Mich."



"By courtesy of Mr. G. N. Malm, author of 'Treatment of Walls and Ceilings' published by Acme White Lead and Color Works, Detroit, Mich."

Plate 34.—Lining with the Angle Liner Brush and Yardstick.

stripes, but not necessarily so. In any event do not use too many colors, nor too bright; usually two are plenty,

and these should be selected after studying well patterned and colored rugs.

It is possible to carry out some stencils in two or even three colors. For instance, the leaf design in Plate 33 might be used in quite a large room (it is 15 inches wide) to form a border for a painted rug. The two stripes in the outer edge can be outlined in pencil and filled in with raw umber tint. The first set of leaves

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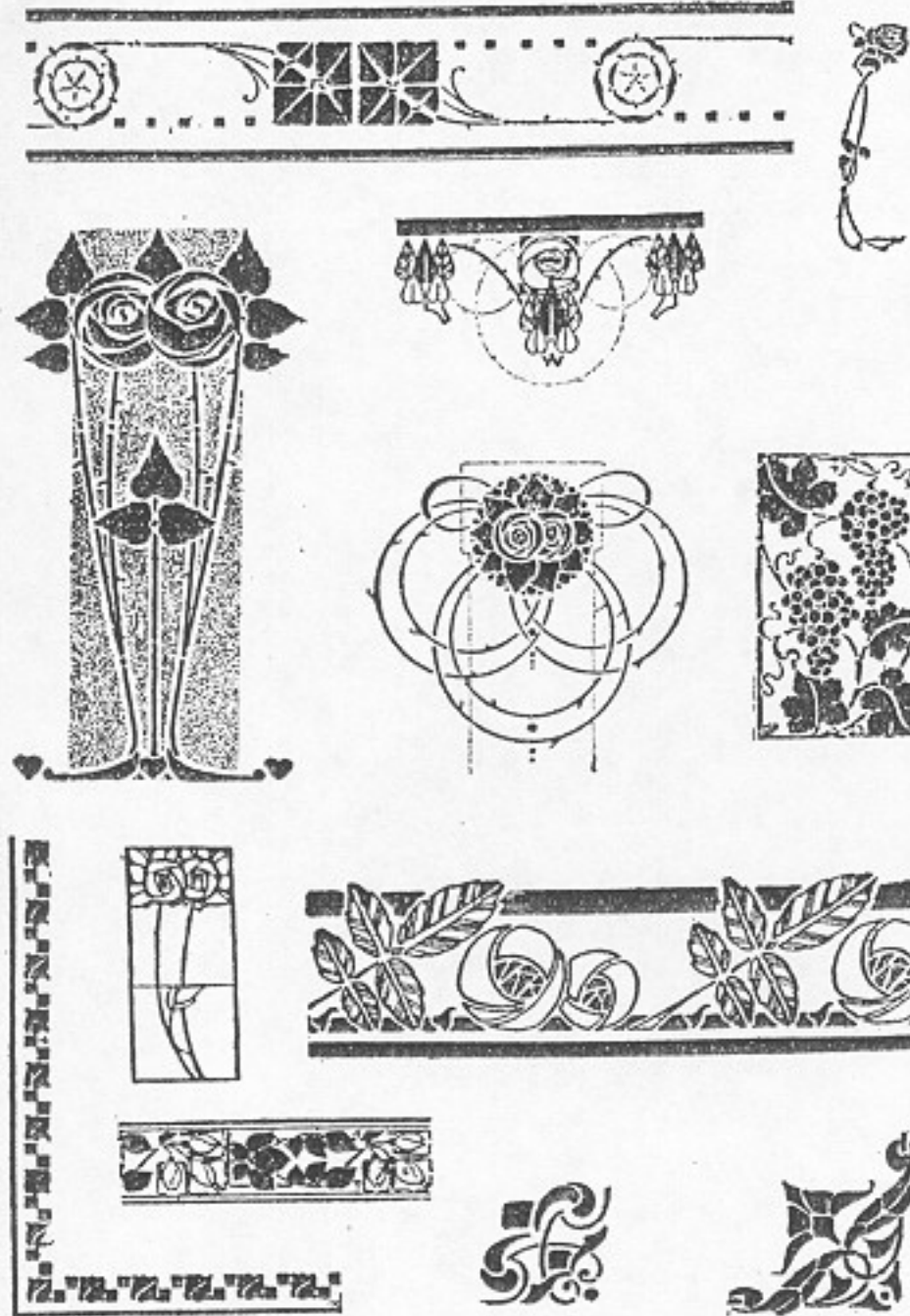


Plate 33.—English Stencil Designs.

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fill in with a green and the second pair tint with a raw sienna. Tint the third pair of leaves like the first, and the fourth pair the same as the second, and so on alternately. With the other stencil shown in the plate a two-color scheme could be carried out by filling in one section with one tint and the second section with another alternately.

Wax or Varnish.—Floors are expected to stand extremely hard wear. Varnish put into the paint will prolong its life, but it is well worth the additional expense to varnish the floor over the paint, which will protect the stencil or striping design. Two coats of varnish and a coat of wax is best. To wax the floor without the varnish will protect the paint somewhat and is better than no protection at all.

Color Suggestions.—Lighter tints may be used ap-

propriately in bedrooms than in other rooms. In every instance the stencil color ought to be but a shade or two darker or lighter than the floor color. A strong contrast does not look well.

Floor color, Bedford stone; stencil or border, pearl gray.

Floor color, light slate; stencil or border, dark slate.

Floor color, slate; stencil or border, dark bottle green.

Floor color, pearl gray; stencil or border, medium olive.

Floor color, French gray; stencil or border, dark bottle green.

Floor color, warm gray; stencil or border, maroon.

Floor color, medium drab; stencil or border, warm drab.

Floor color, tan; stencil or border, chocolate brown.

Floor color, dark umber tint; stencil or border, French gray.

Floor color, bronze gray; stencil or border, medium olive.

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STENCILING ON CLOTH

The ornamentation of fabrics is of interest to the decorator, because he is occasionally called upon to carry wall designs on to furnishings such as window drapes, table covers, and portières in order to complete a decorative scheme. There is not much difference between the methods required for transferring the designs to fabrics and for wall work; still some details are manipulated differently, so only the points of difference will be touched upon. There can be no advantage in repeating unnecessarily what has been said in other chapters about stencils and stenciling in general.

Method of Procedure.—The work on fabrics is best done by doing the stenciling on a drawing-board. Lay several sheets of newspaper on the board first. Then a sheet of blotting paper (white is best), to take up any excess of color and avoid having it crawl. Now stretch the fabric to be decorated on top of the blotting-paper and smooth it out. Place pins in the four corners to hold the fabric in place. See that the horizontal threads run square with the vertical threads before pinning the corners.

Next mark off with chalk, a soft pencil, or thread, the guide lines locating the design where you want it. Lay the stencil plate square and in the correct position. Pin it down fast with thumb tacks or push pins. You are now ready to lay the color on with the correct size of stencil brush.

Colors.—Mix the same semi-transparent colors as are used for wall decorating, with turpentine, adding a few drops of japan gold size or varnish as a binder, so that the color will remain fast during the washing. It is obvious on first thought that the color should be mixed thinner for thick woolly goods than for fine smooth fabrics, but do not thin it to the point of running. If you

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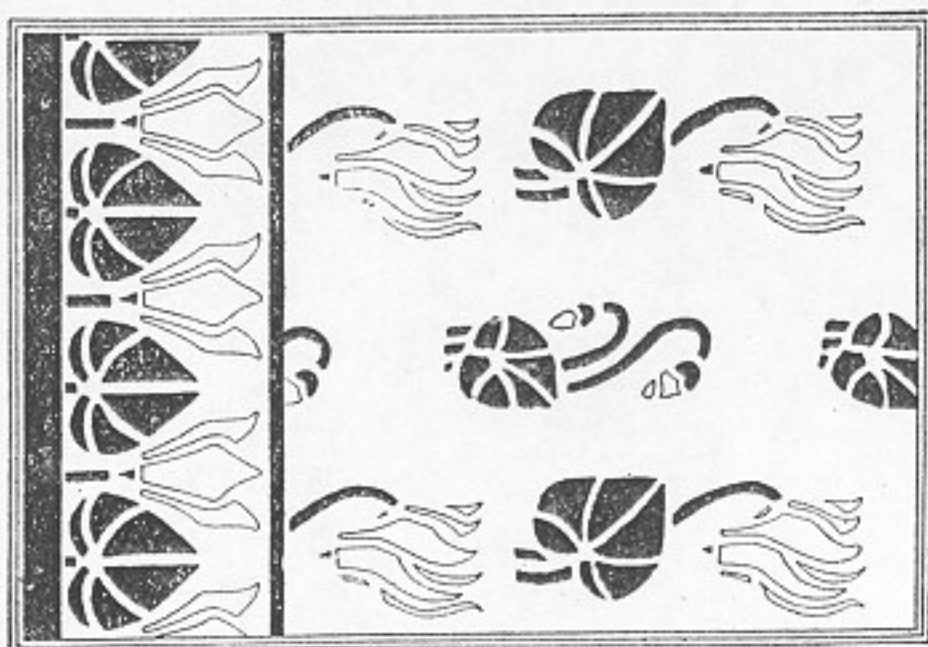
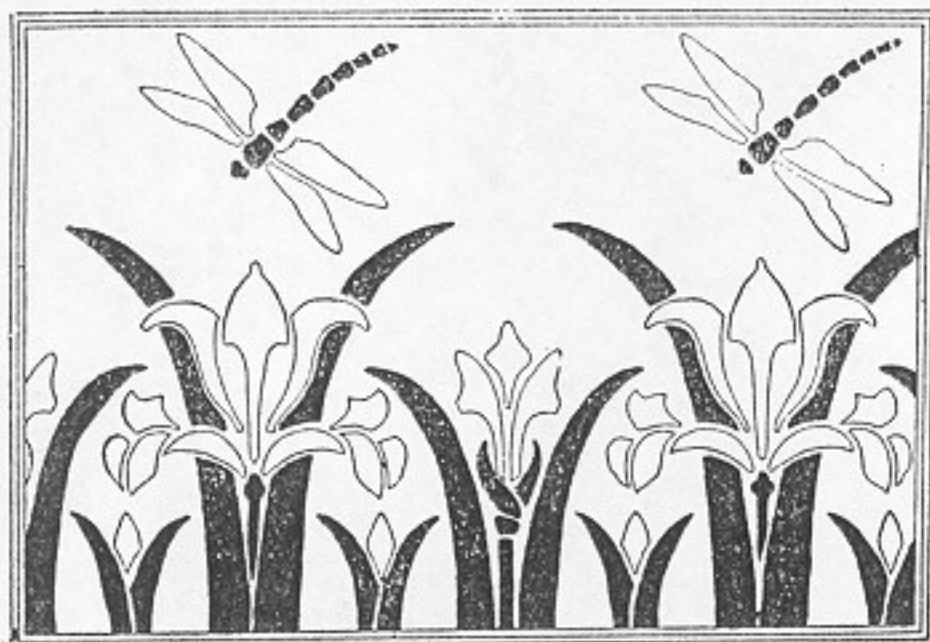


Plate 36.—French Stencil Designs.

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use too much japan gold size, varnish, or drier, the color will finish with a gloss instead of flat, as it should be.

Use tube oil colors for stenciling on linen, cotton, canvas, muslin, and other fabrics except silk velvet and velours. Use dyes for these latter fabrics. The dyes needed are those commonly used for clothing. To one package of the dye add two tablespoonfuls of water and the white of one egg.

Whether you use colors or dyes, do not dip the stencil brush into the mixing pot. Spread a little of the color on a piece of glass with another brush. Then pick it up on the stencil brush from the glass. A surprisingly dry brush transfers the cleanest and sharpest impressions, especially on thin, smooth goods. Too much color in the brush gives a mussy, ragged design.

Fixing Dyes on Velvet.—After stenciling with dyes, when the dye is dry, lay a damp cloth over the top of the design (with fabric on the ironing-board) and press with a hot flatiron. The steam sets the dyes, so that it stands washing.

When stenciling on velvet and velours, which have a long nap, do not use a stencil brush and the hammer

stroke as with other fabrics. It roughs up the nap too much. Put the color on with a small artist's brush, using careful, smooth strokes as when painting any surface. Before stenciling, wet the surface of the cloth and let dry, to lay the nap flat. It can be brushed up again after pressing to set the dye color fast.

It is best to stencil all fabrics with as few strokes of the brush as possible, so as to avoid roughing up and pulling out the fiber threads.

When your color runs on smooth fabrics, even though little color has been taken into the brush, the color is setting too slowly. Add a little more japan.

Two or more colors may be used on fabrics, with a plate and brush for each color as on walls. The color

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may also be shaded by brushing some places longer than others.

Always hold the stencil plate down with one hand while working the brush with the other. Then the fabric can not move and spoil the job.

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CHAPTER VIII

LINING AND STRIPING

Lining is a branch of decorating that is indeed useful. It is an accomplishment that would be gained by a larger number of mechanics if they but realized how easily it can be learned by anyone willing to practice diligently for awhile. Fairly straight lines can be made by the stencil and filling-in method, but the work done in this manner can never equal the clean-cut lining resulting from the use of an angle liner brush, a yardstick, and a practiced hand.

Lines of correct proportion and location in a room can be made to supplement stencil or freehand ornaments, or the lines may be the only means of decorating panel, ceiling, or frieze.

Tools and Materials.—Brushes, called flat or round angle fresco liners, made in sizes $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ inches, for making lines of these widths. Shown on Plate 34.

A yardstick. Bevel or chamfer one edge with a plane to make it like a rule. For long lines a stick $\frac{1}{4} \times 1\frac{1}{2}$ inches, 4 feet long, is best.

A chalkline and chalk.

Japan or oil color, thinned with turpentine a little to brushing consistency.

Aluminum, gold, copper, or other metal bronze powders are used for lining also. They should be mixed with good varnish which has been thinned with benzine or turpentine to the consistency of linseed oil, or use bronzing liquid to thin.

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The surface to be lined may consist of almost any material, but ought to have a flat or semi-flat finish.

Laying Out the Lines.—The first thing to determine is the location of the lines. Measure and mark the location at each end of a panel, for instance, with a pencil. Then chalk your line. Fasten one end over the upper mark,

or have a helper hold it. Place the other end of the line over and against the lower mark, and draw the line taut. With the hand that is free pick up the line as near the center of its length as possible, and snap it by letting go quickly. The line will thus transfer a light chalk mark to the surface, which serves as a guide when painting the line in color. The chalk mark should be snapped on both sides of each proposed line to be one-quarter of an inch wide or wider.

Another way, and a better one for some surfaces, is to mark out the lines with a knife, using a straightedge as a guide. Cut only into the ground coats of paint with a paperhanger's blade. Such a line can be followed with the lining fitch, the paint will run only to the knife cut, and a much sharper, cleaner line will result in less time than can be produced with the chalkline method.

Holding the Brush.—Having the lines marked out with chalk or knife, you are ready to proceed. The next, and perhaps the most important of all points to observe, is the holding of the brush. Hold the extreme end of the brush handle, between the thumb and fingers, the thumb on top, as in Plate 34. It is important to have the brush ride at the correct angle. It should sit flat on the surface, not on the point or the heel.

When the brush has been well worked into the color, wipe it out on the edge of the pot. Now place the yardstick on the chalk line, bevel edge next to the wall, and draw your line with *one* long stroke; do not lift the brush from the wall until you come to the end of the yardstick. The edge of your yardstick, which the brush

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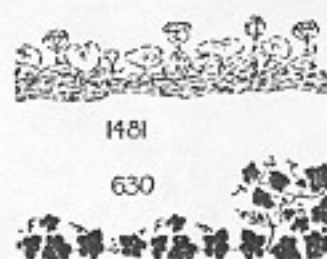
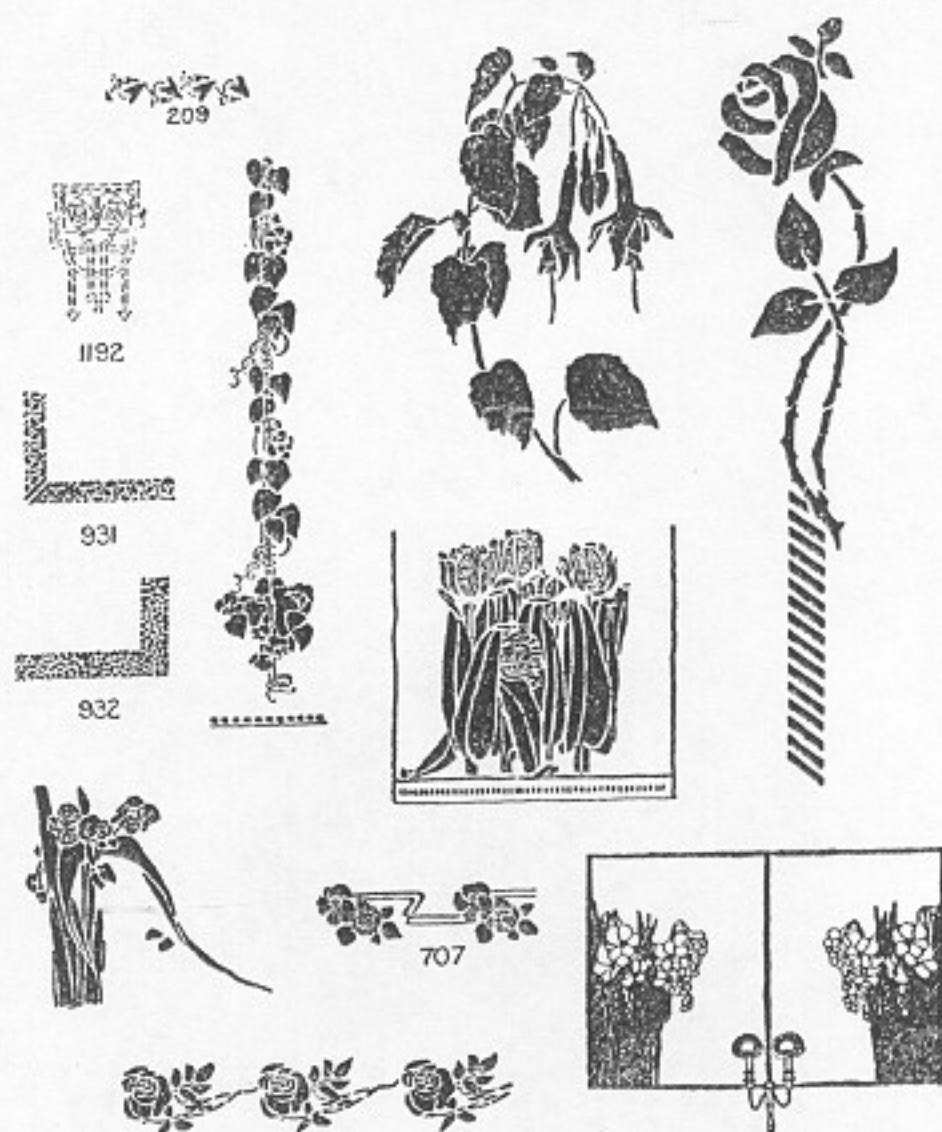


Plate 37.—American Stencil Designs.

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follows, should not come in contact with the wall, or it may smear paint on it.

Move the stick, letting six inches of it remain next to the end of the line just completed, so that an even start can be made on the next section of line. Repeat until the corner is reached, where exceeding care must be exercised to avoid running the line beyond the mark. Lines run too far, or located in error, are difficult to re-



Plate 38.—Japanese Stencil Designs.

move. They may be wiped clean with benzine or turpentine, if at all.

When the color does not flow steadily and evenly from the brush or slides over the surface, it is too thick.

If the color runs and spreads, add a little more pigment color; it is too thin.

Your hands, the yardstick, and the brush handle must be kept clean. When color is allowed to crawl under the yardstick, you soon have a messy line that is a disappointment.

Take care of your brushes. Clean them thoroughly

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with benzine, fill the bristles with vaseline, and lay away flat where they can keep their original shape.

In conclusion, it should be noted that the tools and method are extremely simple. The one requisite to insure success is to practice. Practice continually, and then practice some more. You will then surprise yourself by the really fine work you can turn out rapidly.

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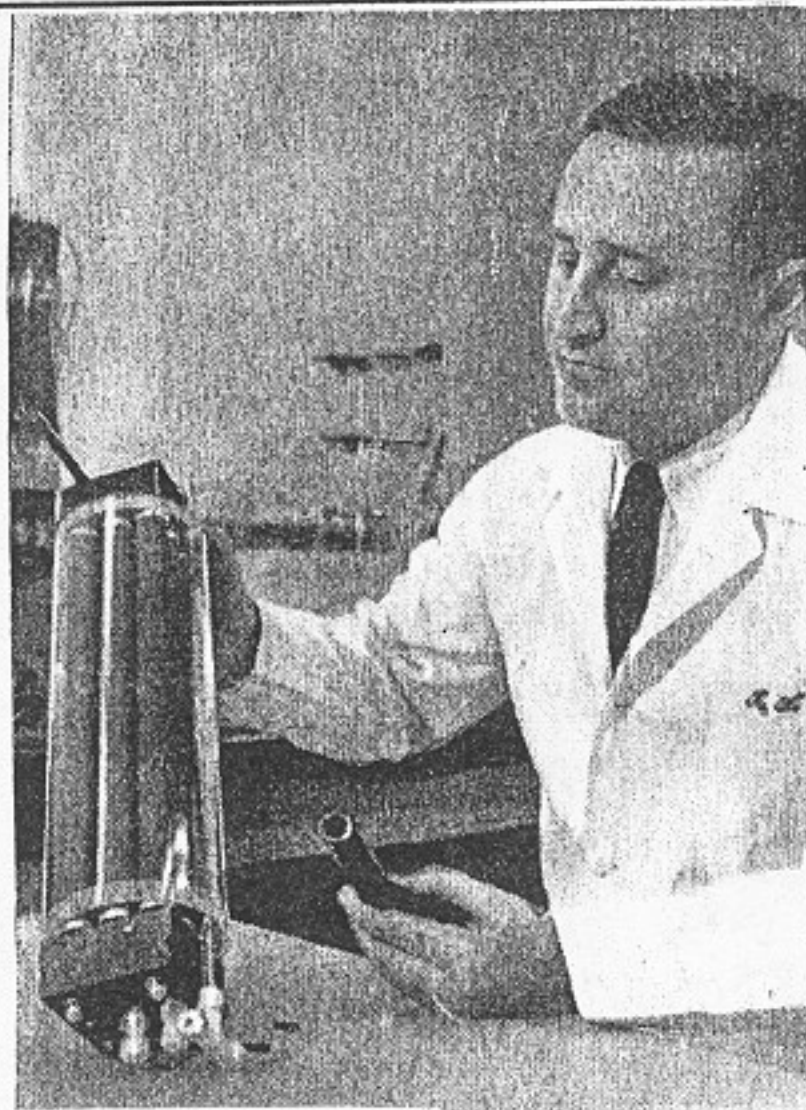
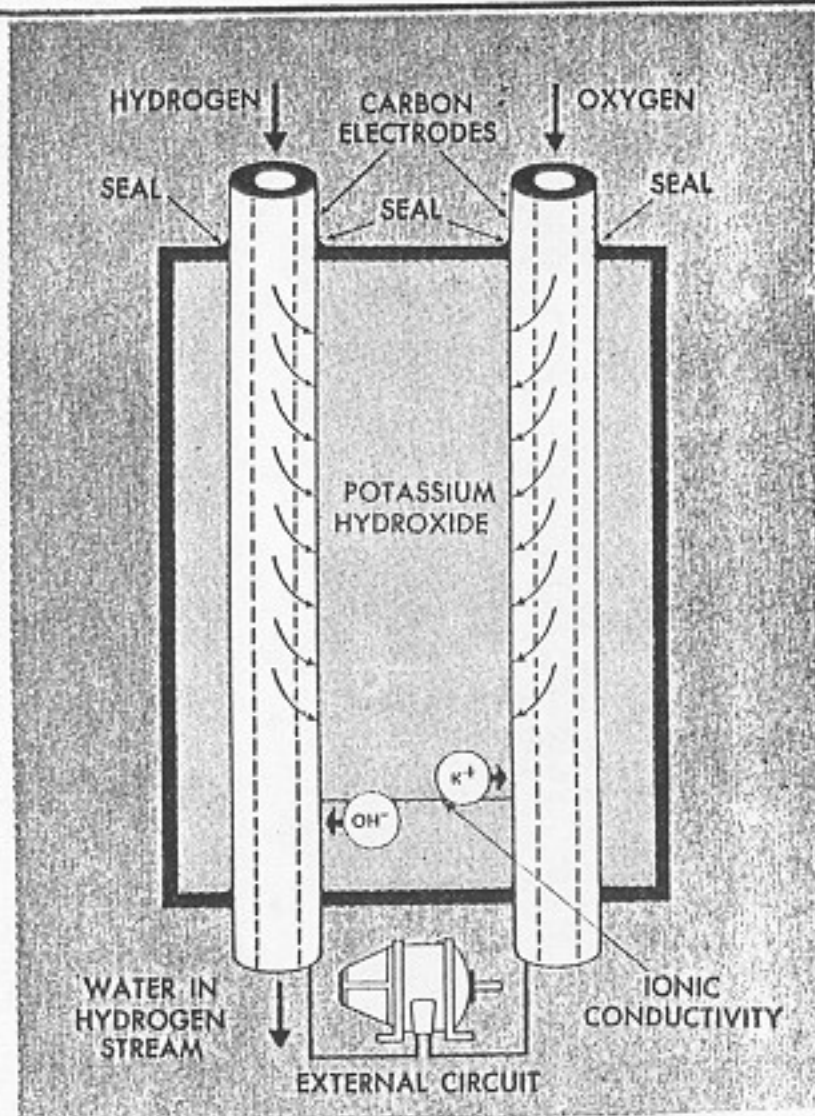
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Popular Mechanics February 1958

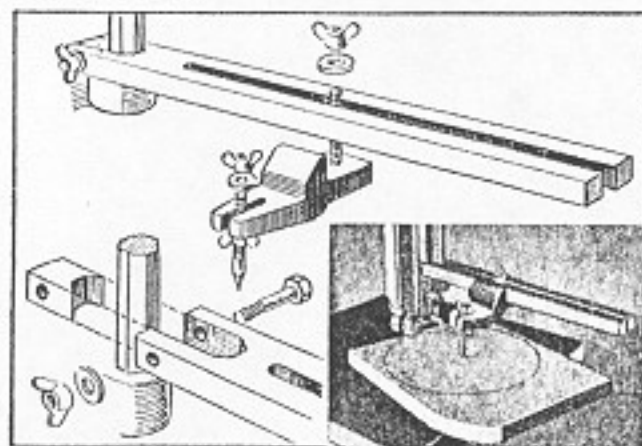
Fuel Cell Changes Chemical Energy Into Electricity

Capable of producing thousands of watts of electric power economically is a new type of chemical fuel package that is portable and virtually maintenance-free. It consists of specially treated, hollow porous carbon electrodes in a cell filled with

potassium hydroxide. Hydrogen and oxygen gases enter the cell through the electrodes and the chemical reaction releases electrons at the hydrogen electrode. As the electrons reach the oxygen electrode they provide electric power.

Jig for Band-Sawing True Circles

Cutting true disks on a band saw is accurately done with the aid of this simple guide. It consists of an arrangement as shown, which has a pointed pivot to swing the work. The pivot must be directly on a line at right angles with the line of cut and neither ahead nor back of the cutting edge of the saw blade. The block that holds the pivot is adjustable for different diameters.—Brooks Hill, Neosho, Mo.



This adjustable guide will handle disks up to a radius equal to one half the table width

BASIC WOODWORKING PROCESSES

By HERMAN HJORTH, M.S.

1935

INTRODUCTION TO STUDENTS

This book is not "just another schoolbook" that you will be required to study from cover to cover. It is a reference book that is going to help you do your woodwork better, more independently, and with greater profit and enjoyment.

You use a reference book when you want to look up something you don't know. For example: When you want to know the meaning of a word, you look it up in the dictionary. You use this book in the same way. When you want to know how to do a certain tool operation, you look it up in the book.

When you do a piece of woodwork, you will have to lay it out according to the drawing from which you are working. You will have to saw and plane boards to dimensions, make some joints, glue the work together, perhaps join some parts of it with nails or screws, and put on hinges, locks, or other hardware. Then you will have to stain and finish it with shellac, varnish, or other materials. All of these operations and many more you will find fully explained in the book and illustrated with photographs and drawings.

Your teacher has, of course, explained the tool operations needed to do a certain job and has also shown you how you should do them. If you remember everything he said, you don't need to refer to the book, but if you forgot something, you can find it here and will not have to wait and ask him again.

If you are ahead of the class, your teacher may give you a more advanced job and let you work independently from a blue print, a project book, or a magazine. You can do this all right if you plan your work step by step and look up those tool operations you are not quite sure about.

It may also be that you have a workshop at home, or that some member of your family or a friend allows you to use his shop. Or perhaps you are a member of a woodcraft club, or you want to earn a scout merit badge by doing some woodwork. If you and your friends have made woodworking your hobby, you will find that this reference book is going to help you a lot, no matter how much or how little you know. You may even make your hobby profitable. Many boys and young men make quite a little extra spending money, either by repairing old furniture or by making new, attractive pieces. Quite often there is also an opportunity to win valuable prizes offered by commercial firms for some specified piece of woodwork or model making.

Woodworking is one of the largest and oldest industries in the world. It is divided into the major trades of carpentry, cabinetmaking, patternmaking, wood turning, carving, cooperage, and wood finishing. Furthermore, wood is used in every engineering job, in box making, and in thousands of articles in everyday use. In order to conserve and protect our supply of lumber, the government maintains a research laboratory, "The Forest Product Laboratory" at Madison, Wis., where all kinds of experiments and tests are made and where new and more economical methods of using wood are developed.

Your study of woodwork is therefore important because it offers so many and varied fields for employment. But even if you are not going to be a woodworker, you may find a lot of enjoyment in working in wood. Most people do, because wood is a material that can easily be transformed by skillful human hands into beautiful as well as useful objects. May this little book help *your* hands to acquire that skill and give you the pride and satisfaction that comes with good workmanship.

INTRODUCTION AND SUGGESTIONS TO TEACHERS

This little book is intended as a textbook for all students of elementary and intermediate woodwork regardless of their age levels and the type of school they may be attending.

It differs from the standard textbook in that it is not to be studied page for page and chapter for chapter. It should rather be used as a reference book, because it lists, describes, and illustrates the most important basic tool operations and jobs that the student of woodworking will have to learn. It also gives related information about hand tools and

various materials used in woodworking. In other words, it should be to the student of woodworking what the dictionary is to the student of English, and be used in about the same manner.

It is the hope of the author that this book will be a distinct help to both students and teachers. While no book can take the place of the teacher's verbal instructions and demonstrations, it may supplement these very effectively, help the student to work independently, and save the teacher the task of endless repetitions and explanations—both verbal and written—of common tool processes. This saving in time and labor will make it possible for the teacher to collect a larger and more varied number of projects selected from blue prints, magazine articles, and project books, thereby broadening the work and making it better organized, more interesting, vital, and individual in character.

In writing instruction sheets, the repetition of many basic tool operations, which are but minor parts of a larger job, is a necessary evil. It is also difficult for the individual teacher to obtain good illustrations and to reproduce the sheets in quantity so that they are legible and not easily soiled or torn. These mechanical difficulties as well as the actual task of writing instruction sheets may be largely overcome by the use of this book. It is merely necessary for the teacher to outline for the student "what to do" and then refer him to the book for directions on "how to do it."

To further illustrate the use of the book a few sample job sheets have been added (pages 228 to 241). Each job sheet or outline begins with a short definite statement of what the student has to do before he is allowed to begin work. This compels him to study his problem in the same way that he would study a lesson in an academic subject.

1. He is told to study the drawing and make out a bill of material and a cutting list. If he can do this correctly, it indicates that he at least understands the drawing. With a cutting list he is also less likely to make mistakes and waste material when getting out stock.

2. He is also told to make templates of any curved parts. This is a further check on his understanding of the drawing and is in itself a valuable lesson in measuring and drawing. If he is working from a project book, he should also copy the drawing on a separate sheet of paper to save the book from being torn or soiled.

3. He is finally asked to write down the answers to the questions at the end of the outline. To be able to do this, he must have read the complete outline and possibly looked up one or two references. (References to related information contained in other books should be given when necessary or desirable. All such references should be specific.)

The teacher may now be reasonably assured that the student understands the problem. He is then told what kind of wood to use and permitted to begin the construction of his project. In following the outline, he is referred to the book for directions on how to do certain tool operations. The younger and less experienced he is, the more he will need these directions. The outlines should, therefore, be more complete for the simpler projects. Older students should learn to plan their own work and outline a method of procedure for approval by the teacher.

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Chapter I

SHARPENING OPERATIONS

1. Sharpening a Saw.
2. Sharpening a Plane Iron or a Chisel.
3. Sharpening a Gouge.
4. Sharpening a Cabinet Scraper.
5. Sharpening a Hand Scraper.
6. Sharpening an Auger Bit.
7. Cleaning a File.

3

Chapter I

SHARPENING OPERATIONS

The proper sharpening of tools is one of the most important things for woodworkers to learn, for tools do not stay sharp very long, especially when used on hard woods, and good work cannot be performed with dull tools.

Time taken to sharpen tools is *time saved*, because a sharp tool cuts faster, easier, and more accurately than a dull one.

1. Sharpening a Saw. The process of sharpening a saw may be divided into three main parts: jointing and shaping, setting, and filing.

1. Jointing is necessary only when the teeth of a saw have been damaged by abuse, or worn uneven after repeated filings and hard usage. The procedure is as follows:

2. The saw is clamped in a saw vise, and a flat mill file is run length-

wise over the teeth. This is continued until every tooth has been touched by the file. A special holder for the file can be obtained (Fig. 1).

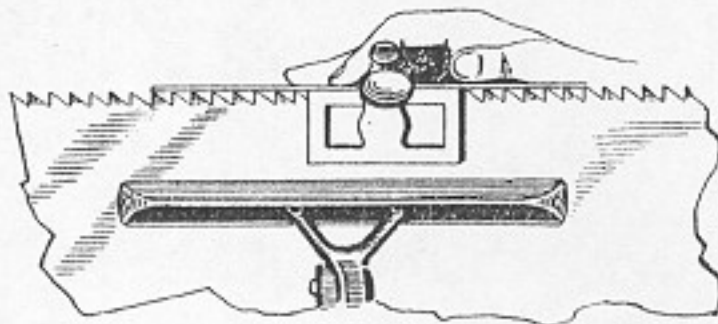


Fig. 1. Jointing a saw.

3. The teeth are now all of the same height, but some may be almost flat, while others have barely been touched by the file. They are filed to the correct shape with a triangular file of the proper size. A 6-in. slim-taper file is suitable for the average handsaw. The saw is clamped in the vise with the handle to the right, the file is held level and at right angles to the saw blade, and filing is begun in the gullet nearest

4.

5. handle. No attempt should be made to bevel the teeth of a cross-cut saw when filing them to shape.

4. The blade is filed down until the tooth to the right is up to a point, and half of the flat end of the tooth to the left has been removed. This is continued in the next gullet to the left until all the teeth have been filed to shape. This operation requires a good deal of practice and should, therefore, be done by experienced workmen. It is recommended that the learner practice on an old saw with a new one as a model before him.

5. **Setting** is the process of bending the teeth of the saw slightly outward. The reason for this is to make the saw cut, the "sawkerf," wider than the thickness of the saw blade (Fig. 2). If a saw is sharpened without being set it will cut only a few strokes before it begins to bind and buckle. If oil or grease is put on the sides of the saw it will only make matters worse because the oil will be rubbed off on the sides of the wood, making an unsightly grease spot that will give trouble later when staining the work (Art. 118, step 4). The only way to prevent a saw from binding is to set the teeth. *All saws need set.*

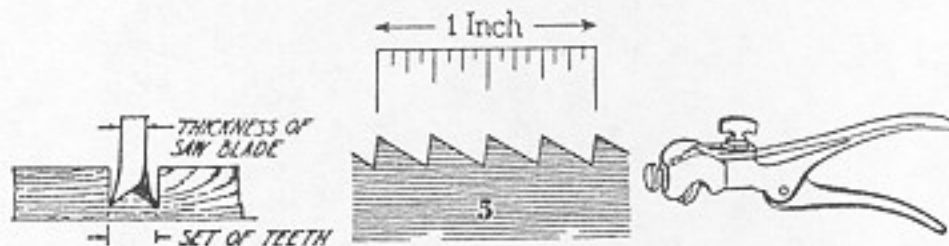


Fig. 2. Set of teeth showing clearance.

Fig. 3. Five points to the inch. Four complete teeth.

Fig. 4. Saw set.

6. The amount of set corresponds to the size of the teeth. By the size of the teeth is understood the number of tooth points to one inch of length. This number usually is stamped on the saw blade near the handle, but if it is not, a rule is placed on the teeth and the number of points in one inch are counted, including both the first and the last points. If five points are counted as shown in Figure 3, the saw is said to have "five points to the inch" although in reality it has only four and one half teeth.

7. The bending and setting of the teeth is done with a special tool called a saw set (Fig. 4). Saw sets are made in several different forms. One of the most common is a tool resembling a plier having a plunger working against a cylindrical drum of uneven thickness. The edge of

5

this drum is numbered to correspond with the number indicating the points to the inch.

8. The saw set is adjusted to the size of the teeth in the saw to be set. The saw is clamped in the vise, and the teeth are set in the same direction in which they were previously bent. The teeth that point

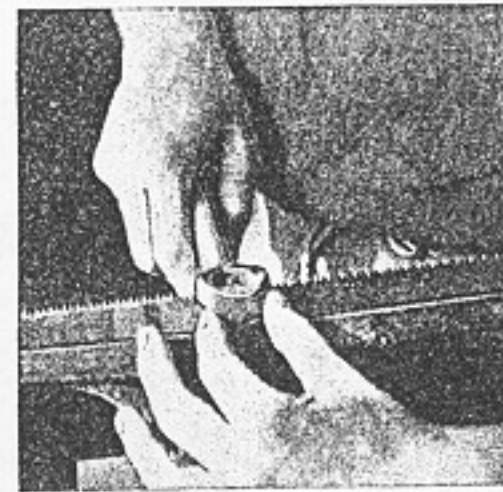


Fig. 5. Setting a saw.

away from the worker are bent first; that is, every other tooth. Only the upper half of the tooth is bent. The saw is reversed in the vise, and the other half of the teeth are set in the same way; that is, they are bent away from the worker (Fig. 5).

9. It is necessary to file or point the teeth quite frequently so that they do not lose their shape. This process often is done without first setting the saw.

10. Ripsaws are filed straight across, because their teeth are shaped like chisels (Figs. 6 and 7). The saw is clamped, with the handle to the right, in a saw vise or between two pieces of wood in a bench vise so that the gullets of the teeth are about $\frac{1}{8}$ in. above the jaws of the vise or boards.

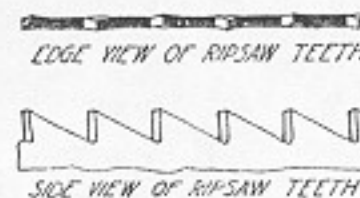


Fig. 6. Ripsaw teeth.

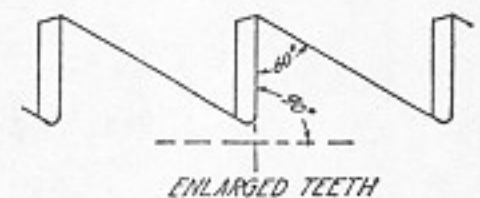


Fig. 7. Enlarged ripsaw teeth.

11. Filing is begun from the point of the saw, starting the file in the gullet to the left of the first tooth bent toward the worker. The file is held level and at right angles to the saw blade, with its sides touching the front of one tooth and the back of the one adjoining at the same time. Two or three light strokes are taken straight across the tooth. This process is continued in every other gullet until the handle has been reached (Fig. 8).

6

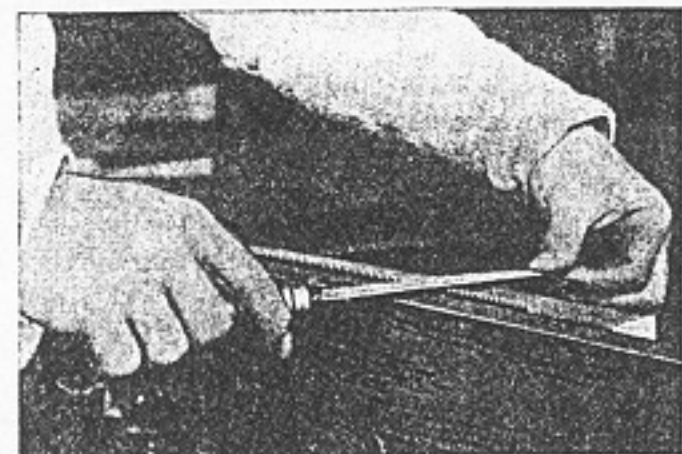


Fig. 8. Filing a ripsaw held between boards in a bench vise.

12. The saw is reversed in the vise, placing the handle to the left, and the remaining half of the teeth are filed.

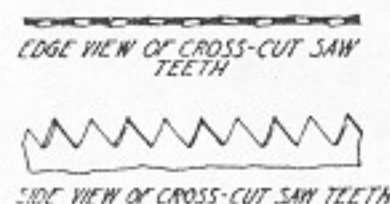


Fig. 9. Crosscut-saw teeth.



Fig. 10. Enlarged crosscut-saw teeth.

13. The teeth of a crosscut saw are filed to a knife point (Figs. 9 and 10). The saw is clamped in the vise in the same manner as a ripsaw, and the file is held level but at an angle of about 60 deg. to the blade of the saw. In this way a bevel is filed at the same time on the

front of one tooth and the rear of the one adjoining (Fig. 11).

14. Backsaws and dovetail saws are crosscut saws and are, therefore, filed like these, but with a $4\frac{1}{2}$ -in. extra-slim taper file, which is a small triangular file.

15. A saw may be made to cut smoother if the burr produced by the file is removed from the teeth. This is called "side-jointing" and may be done by laying the saw on a board and rubbing each side with an oilstone. The oilstone is passed over the teeth two or at the most three times, and is rubbed very gently so that the set of the saw is not re-

7

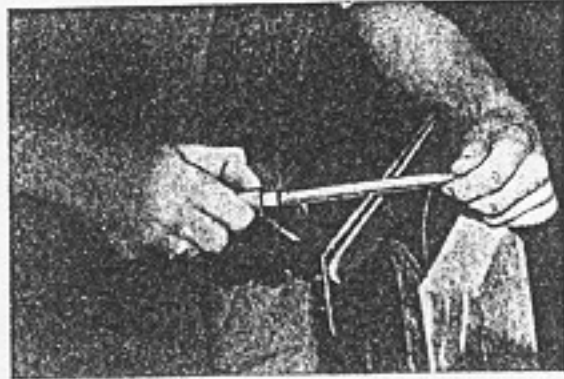


Fig. 11. Filing a crosscut saw held in a saw-filing vise.

duced (Fig. 12). For ordinary work side-jointing may be omitted as it is a particular job requiring skill and judgment.

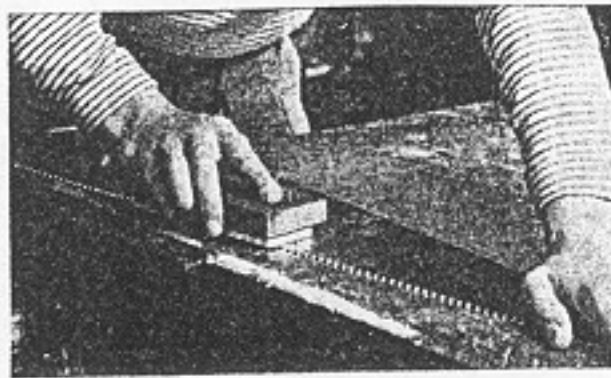


Fig. 12. Side-jointing a saw.

QUESTIONS

1. What is understood by jointing a saw, and when should it be done?
2. How are the teeth of a saw shaped after jointing?
3. If the saw binds in the wood, what is the probable cause?
4. How may the following sentence be completed? The more a saw is set, the wider is the
5. What is understood by "points to the inch"?
6. What does a saw set look like, and how is it used?
7. How is a rip saw clamped and filed?
8. How does the filing of a crosscut saw differ from that of a rip saw?
9. Why does side-jointing improve the cutting quality of a saw?

8

2. Sharpening a Plane Iron or a Chisel. Plane irons, chisels, and spokeshaves are all sharpened in the same way, because all these tools have one beveled side and one flat side. The sharpening processes are two: grinding and whetting.

1. Grinding is necessary when the cutting edge has been nicked, or the bevel has become too short or rounded as a result of too much or careless whetting.

2. Grinding is done on the beveled side only. A rough stone, such as a sandstone or an emery wheel, is used for this purpose. Three things must be accomplished in grinding: (1) The bevel must be uniform, and flat or slightly concave; (2) the edge must be square to the sides of the iron, and (3) the iron must be kept cool during the grinding process to prevent burning.

3. To get a uniform bevel, the tool is held firmly in the same position throughout the grinding process. This can best be done by means of a tool holder or toolrest. When using an old-fashioned grindstone, a wooden block, beveled to an angle of 75 deg., affords an excellent tool-

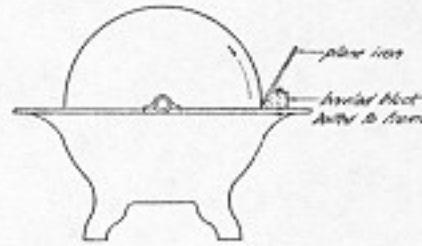


Fig. 13. Old-fashioned grindstone.

rest (Fig. 13). The block is bolted to an iron frame so that its beveled edge almost touches the stone. The tool is held on the block, pressed firmly against the stone, and it is moved sideways across its face while being ground. The stone revolves toward the tool as shown by the arrow. The tool may be inspected as often as desired during the grinding process without fear of changing the angle of the bevel, which will be 25 deg.

4. The modern emery-wheel grinder usually is provided with a tool holder which can be set at different angles. The tool holder should be adjusted so that the length of the bevel ground is equal to fully twice the thickness of the tool. This makes a grinding angle of about 25 deg. The tool holder is moved from side to side across the edge of the stone while grinding (Fig. 14). The stone always should revolve toward the tool, because it will cut faster and a smaller wire edge is formed this way. The edge should be ground so that it is square with one of the sides. A try-square is used to test the edge for squareness (Fig. 15).

5. When the steel becomes overheated or "burned" during the grinding process it turns a blue-black color. This must particularly be avoided, because burning draws the temper of the steel and makes it soft, and soft steel cannot be sharpened. Tools must, therefore, be cooled while grinding, either by kerosene or water dripping on the

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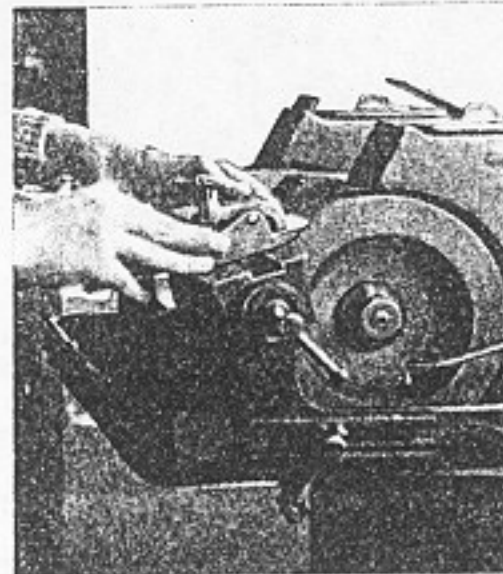


Fig. 14. Grinding a plane iron on an oilstone grinder. Kerosene drops on inside of cup wheel and filters through to the surface.



Fig. 15. Testing the edge of a plane iron for squareness.

grinding wheels. Cooling tools by frequent dipping in water is a makeshift and very difficult for the inexperienced.

6. Whetting is always necessary after grinding, because the wire edge formed on the tool is thereby removed. However, a tool may be sharpened only by whetting two or three times between grinds.

7. Whetting is done on a hard, fine stone called an oilstone. Oilstones are either artificial or natural stones. The artificial stones are sometimes made with one coarse and one fine side. Natural stones are found near Hot Springs, Arkansas. Water should never be used on an oilstone, because it allows particles of steel to become imbedded in its surface, giving it a black, shiny appearance (glazing) and preventing it from cutting. Kerosene to which a little machine oil has been added keeps the surface of the stone clean and in good cutting condition. The whetting process is begun by holding the plane iron so that the whole bevel is in contact with the stone; it is then raised slightly, and rubbed back and forth over the stone. If as much of its surface as possible is used, it will prevent uneven wear (Fig. 16). The iron should be held firmly and with an even, moderate pressure so that its angle with the stone is not changed.

8. The plane iron then is reversed and its flat side is placed in contact with the stone. It is rubbed back and forth a few times, pressing



Fig. 16. Whetting a plane iron, bevel down.



Fig. 17. Whetting a plane iron, bevel up.



Fig. 18. Finishing the whetting of a plane iron by drawing it over a smooth hardwood block.



Fig. 19. Testing a plane iron for sharpness on thumb nail.

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down on it and being careful *not to raise it the least little bit* (Fig. 17). If this should happen, the tool must be reground, because it will not cut properly.

9. The iron again is reversed and the whetting movement repeated until the wire edge is removed. This edge usually drops off on the oilstone and appears as a silvery thread.

10. The whetting is finished by drawing the plane iron once or twice over a smooth hardwood block (Fig. 18). It is tested for sharpness on the thumb nail. If the iron is sharp it takes hold in the nail; if it is not sharp it slides over the nail (Fig. 19).

11. When a plane iron or other cutting tool becomes dull, its edge shows as a fine, white line. If the tool is sharp, its edge is invisible. It should be made a rule *before using a plane or chisel always to look at its edge*. A few minutes spent in sharpening a plane iron or a chisel repays the worker both as to the quality of the work produced and the time needed for its execution.

12. The uneven surface of a worn oilstone can be redressed by rubbing the stone on a flat, iron surface, using powdered emery and kerosene as an abrasive.

QUESTIONS

1. What is the difference between grinding and whetting?
2. A chisel or plane iron should be ground when its edge is or
3. When the edge of a tool becomes blue while grinding it is said to be

4. Why should a stone always revolve toward the tool being ground?
5. It is necessary to whet a tool after grinding it to remove the
6. Why should water not be used on an oilstone?
7. What are the three things to be accomplished in grinding?
8. How should a plane iron or a chisel be tested for sharpness?
9. How can one tell by looking at a chisel or a plane iron if it is sharp or dull?
10. How can the surface of a worn oilstone be made flat?

3. **Sharpening a Gouge.** 1. A gouge is simply a chisel the blade of which has been rounded lengthwise. Some gouges have the bevel on the inside (inside-bevel gouges), and others have the bevel on the outside (outside-bevel gouges).

2. An outside-bevel gouge is ground on an ordinary emery wheel or a grindstone. It is ground as a chisel, but is moved across the face of the stone with a rolling motion during the grinding process. An inside-bevel gouge is ground on a cone-shaped emery wheel.

3. Small oilstones having rounded edges of various shapes should be used to whet gouges. Such stones are called slip stones. Gouges are whetted in the same way as other edge tools, but when whetting the

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concave side the tool is held still while the stone is rubbed over it (Fig. 20). The stone should be kept in contact with the flat side of the gouge to avoid making two bevels.

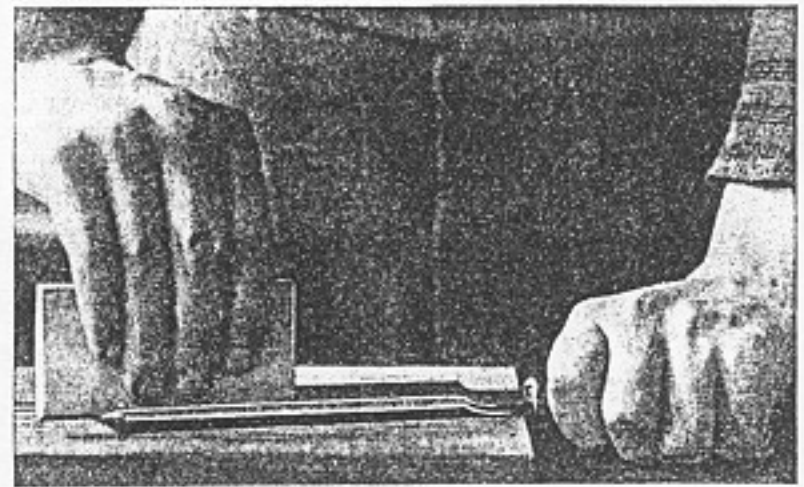


Fig. 20. Whetting inside of gouge with slip stone.

QUESTIONS

1. How is an inside-bevel gouge ground?
2. How are gouges whetted?

4. **Sharpening a Cabinet Scraper.** 1. The sharpening of a cabinet scraper falls into three divisions: grinding, whetting, and bending the edge. The first two of these are done in exactly the same manner as the sharpening of a plane iron (Art. 2).*

2. To bend or turn the edge, the scraper is clamped in a bench vise. The burnisher is held so that it is in contact with the whole bevel; it is raised slightly, and moved across the edge of the blade with a light pressure. The burnisher is elevated more in the succeeding two or three strokes until it forms an angle of about 15 deg. with the horizontal (Fig. 21). The best results are obtained when the scraper has a keen edge before bending. A drop of oil should be rubbed on the burnisher.

3. A burnisher is simply a bar of smooth, hard steel. An excellent burnisher can be made from an old triangular file by grinding away the teeth and rounding the corners slightly.

*Throughout this book the abbreviation *art.* or *arts.* refers to the word *article* or *articles*, as the case may be.

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Directions for adjusting and using a scraper are given in Planing Operations, Article 42.

QUESTIONS

1. What are the three operations necessary for sharpening a cabinet scraper?
2. How could a burnisher be made?

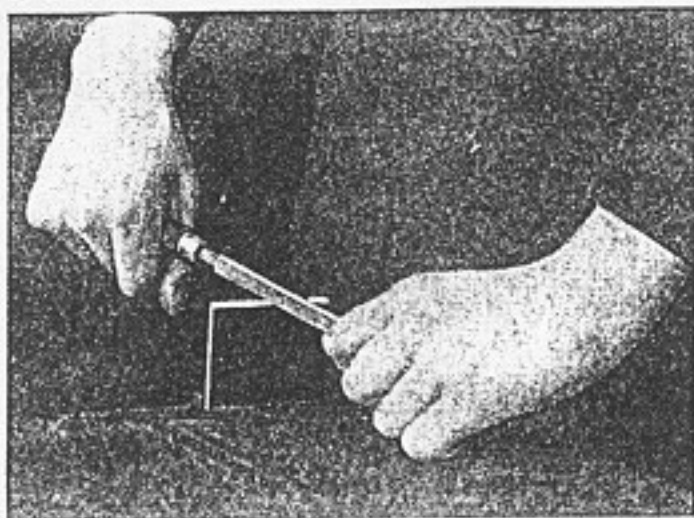


Fig. 21. Bending edge of cabinet scraper with burnisher.

5. Sharpening a Hand Scraper. 1. The scraper is clamped in the bench vise with one of the long edges up.

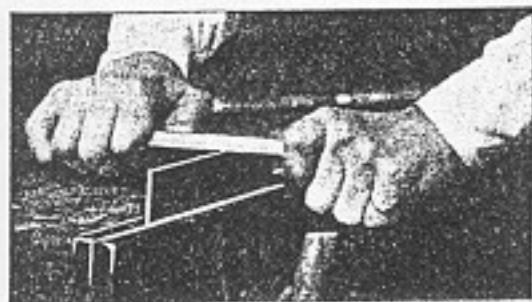


Fig. 22. Draw-filing hand scraper.

2. A flat mill file or a triangular file is held level across the edge of the scraper, one hand on each end of the file. The file is moved back and forth along the scraper until its edge is straight, flat, and square to the sides (Fig. 22). It should not be filed hollow in the center. This method of filing is called *draw-filing*. The scraper then is reversed in



Fig. 23. Whetting edge of hand scraper.

the vise and the other long edge is filed. 3. The burr formed by the filing is now removed by whetting the scraper on an oilstone. The scraper is held perpendicular to the stone to whet the edge (Fig. 23). Each side then is held flat against the face of the stone as when whetting the flat side of a plane iron (Fig. 24).

4. The edges of the scraper may be turned in several ways. One of the easiest ways is to hold the burnisher flat on the workbench and rub the edges of the

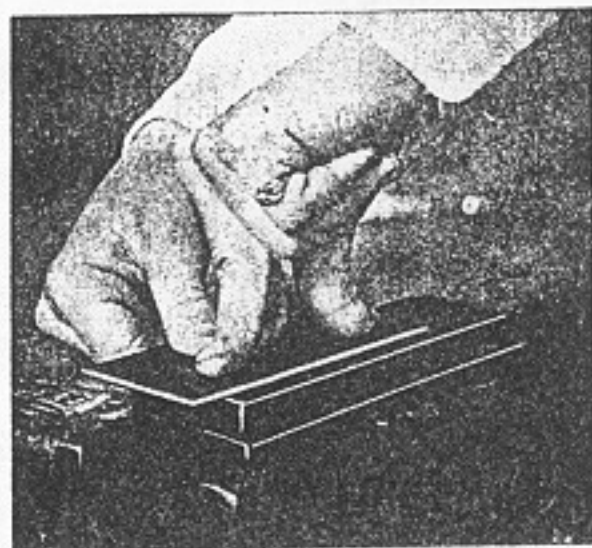


Fig. 24. Whetting side of hand scraper.

between boards and turn the edges in the same way as the edge of a cabinet scraper is turned (Fig. 21). Still another way is for the worker to hold the scraper flat over the edge of the bench and draw the burnisher toward himself upward over its edge (Fig. 26). The scraper is then reversed and its other edge bent in the same way.

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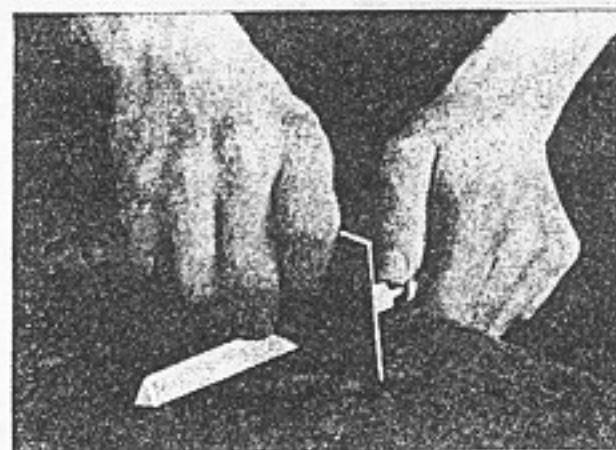


Fig. 25. Turning edges of hand scraper, burnisher on bench.

5. A hand scraper may be resharpened several times without draw-filing and whetting. The scraper is placed flat on the bench top, and the turned-up edges are flattened with a burnisher (Fig. 27). The edges are then turned back again by one of the methods described in step 4.

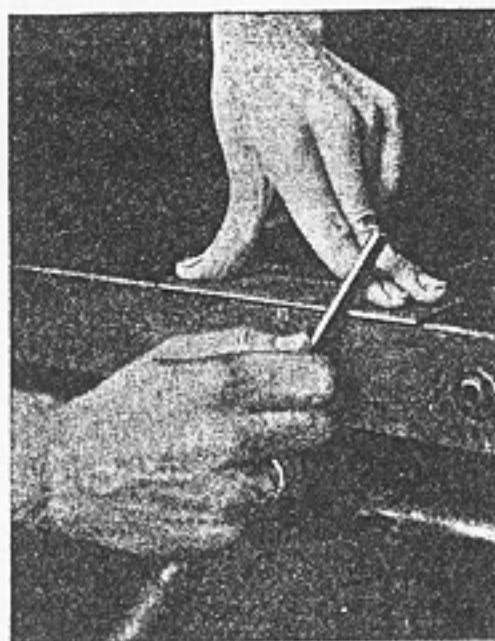


Fig. 26. Turning edge of hand scraper, holding it flat over the edge of the bench.

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Fig. 27. Flattening edges of hand scraper for resharpening.



Fig. 28. Enlarged sections of hand scraper. 1. Sharpened on oilstone, Figs. 23 and 24; 2. Edges turned with burnisher, Figs. 25 and 26; 3. Edges flattened for resharpening, Fig. 27.

Directions for using a hand scraper are given in Planing Operations, Article 42.

QUESTIONS

1. How does the edge of a hand scraper differ from that of a cabinet scraper?
2. What are the sharpening operations necessary for sharpening a hand scraper?
3. If a hand scraper is clamped in a bench vise while turning its edges, why should boards be used between the vise jaws and the scraper?
4. How is a hand scraper resharpened without draw-filing?

6. **Sharpening an Auger Bit.** An auger bit easily becomes dull after boring in hard wood, or if, in repairwork, a nail or screw is en-



Fig. 29. Filing nibs on
auger bit.

it. An auger bit easily becomes dull. If, in repairwork, a nail or screw is encountered. It can be resharpened by filing with a small file made especially for the purpose and called an auger-bit file.

1. The nibs or spurs are sharpened by filing them on the *inside*, meanwhile holding the "twist" of the bit against the edge of the workbench with the screw pointing upward (Fig. 29).

2. The lips on the upper side are filed while holding the screw of the bit down against the top of the bench (Fig. 30). An equal amount must be removed on both lips.

3. A bent auger bit may be straightened by striking the high side with a mallet. The bit is rolled on the bench top to find the high side, and is then struck while it is lying on the bench.

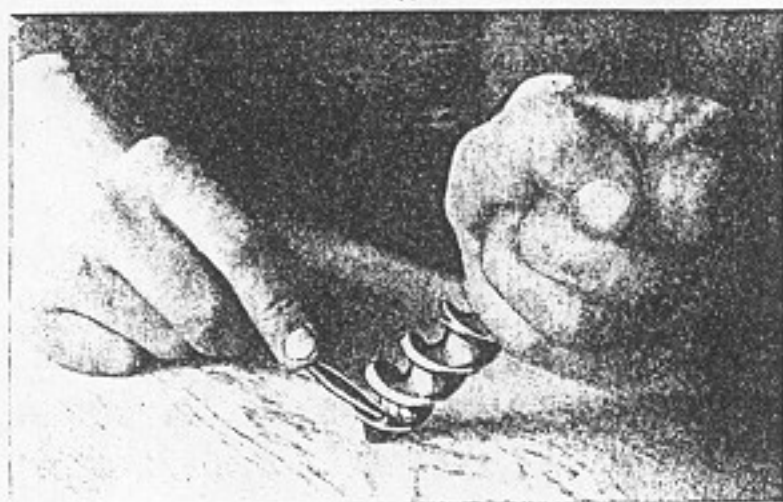


Fig. 30. Filing lips on auger bit.

QUESTIONS

1. Why should the nibs or spurs be filed only on the inside?
2. How are the lips sharpened?
3. How can a bent auger bit be straightened?

7. **Cleaning a File.** The teeth of a file very easily become clogged with particles of wood lodging between them, especially when the wood is resinous. This can be removed in two ways, by soaking in hot water or by fire.

1. The use of fire is very efficient, but dangerous if not done carefully. The file is held by the handle and dipped into a wide-necked

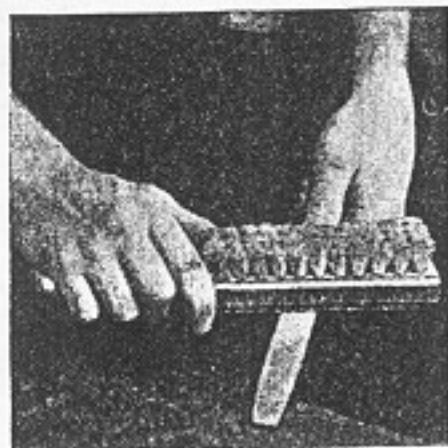


Fig. 31.—Brushing teeth of a file with a file card. The other side of this file card has a wire brush.

bottle filled with denatured alcohol. The bottle then must be corked securely. The file is held in a horizontal position, and a lighted match applied to it. Gasoline never should be used.

2. The alcohol remaining on the file will burn with a small, blue flame, consuming the wood wedged between the teeth. When the flame dies out, the teeth are cleaned by brushing them with a small wire brush called a *file card* (Fig. 31).

3. Soaking in hot water softens the wood wedged between the teeth. The wood then can be brushed out with a file card. This

method is slower and it is likely to rust the file, but it is safer.

QUESTIONS

1. Why should gasoline never be used for cleaning a file?
2. What precautions should be taken when using alcohol for cleaning a file?

3. What is a file card and how is it used?

4. Does the alcohol flame draw the temper of the file?

5. What are the disadvantages of cleaning a file by soaking it in water?

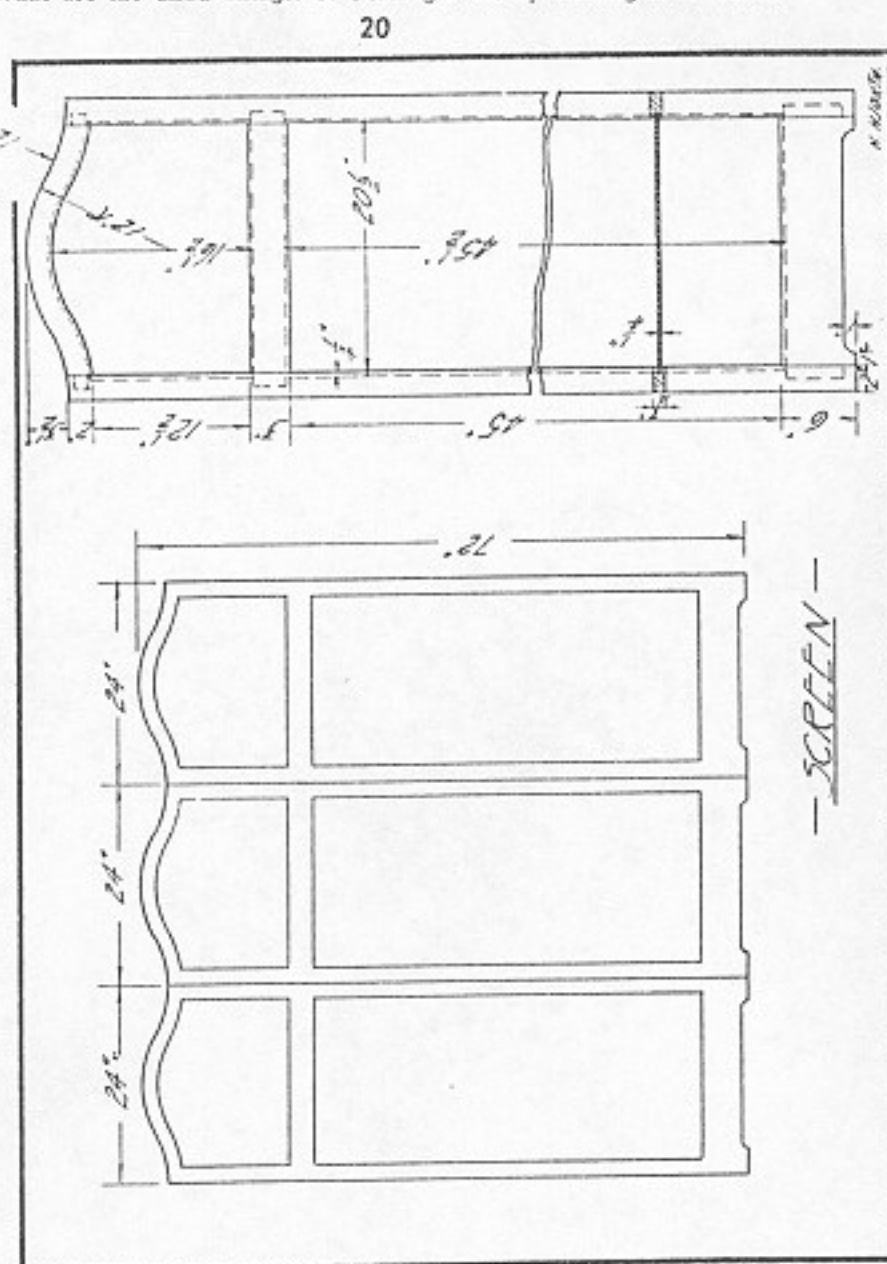


Fig. 34.

Chapter II

LAYING-OUT OPERATIONS

9. Making out Bills of Material.
10. Calculating Number of Board Feet.
11. Measuring with a Rule.
12. Squaring Lines Across and Around a Board.
13. Gauging with a Marking Gauge.
14. Gauging with a Mortise Gauge.
15. Gauging with a Pencil.
16. Drawing Arcs with Dividers, Compasses, or Trammel Points.
17. Drawing an Ellipse.
18. Drawing an Arc without a Radius.
19. Drawing a Polygon.
20. Making Templates.
21. Laying out Angles from a Framing Square.
22. Laying out Duplicate Parts.

Chapter 11

LAYING-OUT OPERATIONS

Accurate and systematic measuring and full-sized reproduction of angles, curves, and constructive details from a drawing to a piece of wood are called "laying-out" or "setting-out" operations. These are

absolutely essential to the production of a good piece of work, and, in industrial plants, are usually performed by the foreman and his assistants.

9. Making out Bills of Material. 1. Before beginning the work of laying out, a complete list must be made of all the different pieces of lumber needed for a job. Such a list is called a "bill of material" or a "finished-stock list." It is made out directly from the drawing, which shows the dimensions of each piece and the method of construction (Fig. 34).

2. A bill of material specifies the wood to be used, lists the number of pieces needed, gives the exact dimensions of each piece, and names the part of the construction for which it is to be used, as sides, legs, top, etc.

BILL OF MATERIAL FOR THREE-LEAF SCREEN

No. of Pieces	Description	Thickness	Width	Length	Wood
6	Sides	$\frac{3}{4}$ " x	2" x	68 $\frac{1}{2}$ "	Oak
3	Bottom rails	$\frac{3}{4}$ " x	6" x	22"	Oak
3	Middle rails	$\frac{3}{4}$ " x	3" x	22"	Oak
3	Top rails	$\frac{3}{4}$ " x	5 $\frac{1}{2}$ " x	22"	Oak
3	Lower panels	$\frac{1}{4}$ " x	20 $\frac{1}{2}$ " x	45 $\frac{1}{2}$ "	Oak plywood
3	Upper panels	$\frac{1}{4}$ " x	20 $\frac{1}{2}$ " x	16 $\frac{1}{2}$ "	Oak plywood

CUTTING LIST FOR THREE-LEAF SCREEN

No. of Pieces	Description	Thickness	Width	Length	Wood
6	Sides	$\frac{3}{8}$ " x	2 $\frac{1}{4}$ " x	69"	Oak
3	Bottom rails	$\frac{3}{8}$ " x	6 $\frac{1}{4}$ " x	22 $\frac{1}{2}$ "	Oak
3	Middle rails	$\frac{3}{8}$ " x	3 $\frac{1}{4}$ " x	22 $\frac{1}{2}$ "	Oak
1	Three top rails	$\frac{3}{8}$ " x	12" x	22 $\frac{1}{2}$ "	Oak
3	Lower panels	$\frac{1}{4}$ " x	20 $\frac{3}{4}$ " x	46"	Oak plywood
3	Upper panels	$\frac{1}{4}$ " x	20 $\frac{3}{4}$ " x	17"	Oak plywood

3. For cabinetwork the dimensions are all given in inches and in the following order: thickness, width, length. Usually the length is the

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greatest dimension, but there are cases where the width is greater than the length (Fig. 35, and upper panels of the screen Fig. 34).

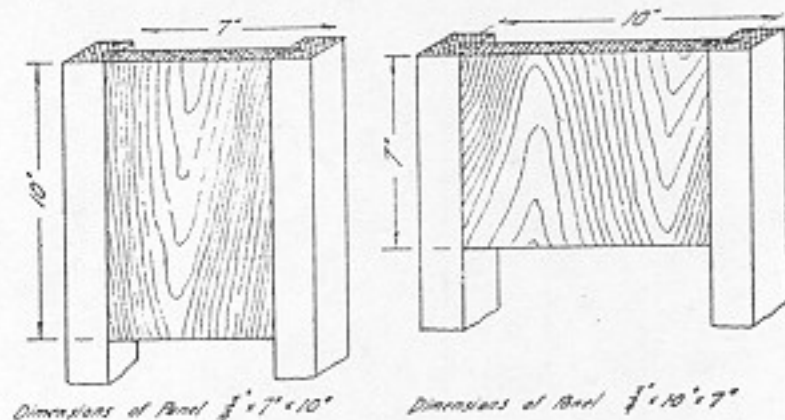


Fig. 35. Dimensions of two side panels. The width of one is greater than its length.

4. A rough-stock list or a cutting list is usually made from the finished-stock list by adding $\frac{1}{8}$ in. to the thickness, $\frac{1}{4}$ in. to the width, and $\frac{1}{2}$ in. to the length (page 21). This is to allow for planing and squaring.

5. Lumber for building purposes is sawed and planed to various standard dimensions. Planed lumber is slightly less in thickness and width than rough-sawed lumber. From $\frac{1}{16}$ to $\frac{1}{8}$ in. is allowed for each planed surface. A planed 1-in. board is therefore only $\frac{7}{8}$ or $\frac{13}{16}$ in. thick. The symbols S2S or D2S, used by lumber dealers, mean surfaced or dressed on two sides. Lumber for cabinetwork is often sold in odd widths and short lengths and at a lower price than charged for standard widths and lengths.

10. Calculating Number of Board Feet. 1. Lumber is sold by the board foot, plywood by the square foot, and molding by the running or lineal foot. A board foot is equivalent to a piece of lumber 1 in. thick, 1 ft. wide, and 1 ft. long.

2. The number of board feet in a piece of lumber is calculated as follows: Thickness in inches $\times$ width in feet $\times$ length in feet = board feet. Planed boards are figured according to their original thickness and width before planing. Example:

1 piece $\frac{3}{4}$ " x 3" x 10'-0" S2S is figured as $1 \times 1 \times \frac{3}{12} \times 10 = 2.5$ b.f.
 2 pieces $1\frac{1}{4}$ " x 6" x 18" S2S is figured as $2 \times 2 \times \frac{6}{12} \times \frac{18}{12} = 3$ b.f.
 4 pieces $\frac{3}{8}$ " x 7 $\frac{1}{4}$ " x 32" S4S is figured as $4 \times 1 \times \frac{8}{12} \times \frac{32}{12} = 7.1$ b.f.

12.6 b.f.

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3. When figuring out lumber bills it is customary to add a percentage (usually 15 per cent) to the total number of board feet for waste in cutting.

QUESTIONS

1. What is included in a bill of material for the four legs of a teacher's desk?
2. The three dimensions of the legs are given in the following order
3. The cutting list is made from the
4. How many board feet of lumber are needed for making the screen in Figure 34?



Fig. 36. Steel tape and wood folding rule.

11. Measuring with a Rule. Rules are used in practically all trades and are, therefore, made in numerous shapes and of many different materials. The ones used by woodworkers are generally made of wood and fold up so they can be put in a pocket (Figs. 36 and 38). They are made in lengths from 2 to 8 ft., and are usually divided in inches on both sides. Some rules, however, have inches on one side and centimeters on the other. Every inch is subdivided into halves, quarters, eighths, and sixteenths.

1. When measuring parts to be cut from stock, the rule is placed flat, and the desired distance is marked with a medium-soft pencil. In such measurements, allowance always is made for sawing and planing to exact size.

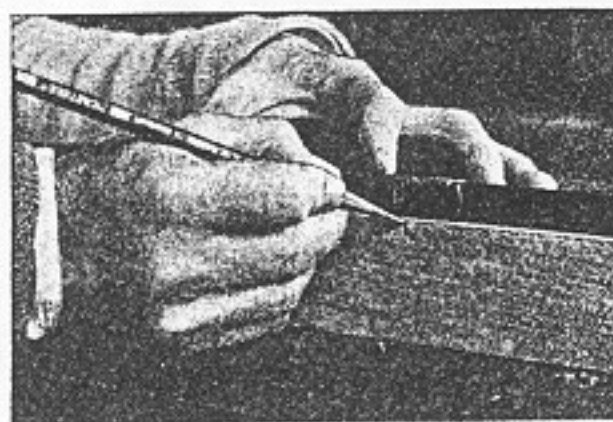


Fig. 37. Measuring with rule on edge, and fine pencil point.

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2. When measuring long distances, the longest rule available is used. The shorter the rule, the oftener it will have to be moved and the more chances there are for making mistakes.

3. When laying out accurate measurements, the rule is placed on edge and the distance is marked with a knife or fine pencil point (Fig. 37). When using older rules, it is better to measure from the 1-in. mark rather than from the end, which may be worn.

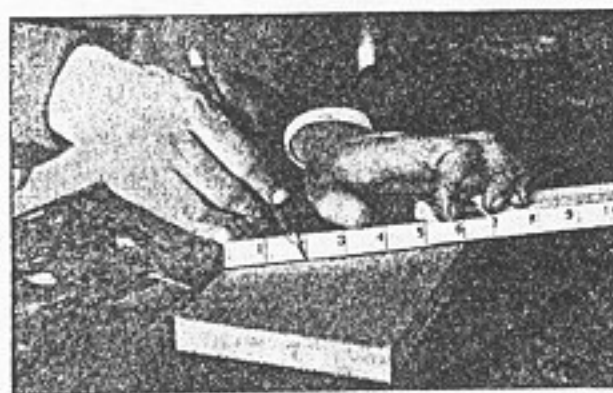


Fig. 38. Dividing a board by placing a rule diagonally. The divisions are marked on the even inch marks.

4. When a board is to be divided lengthwise into a given number of parts, the rule is placed diagonally across the board, so that the divisions can be marked off from whole numbers (Fig. 38).

QUESTIONS

1. What type of rule is commonly used by woodworkers?
2. What are the common units of measurements used by woodworkers?
3. How is the rule placed on work for accurate measurements?
4. What is the advantage and disadvantage in measuring from the 1-in. mark instead of from the end?
5. A board $4\frac{1}{4}$ in. wide is to be divided lengthwise into five equal parts. How can this be done with a rule? How could it be divided into three equal parts?

12. Squaring Lines Across and Around a Board. When a piece must be cut off the end of a board, a line must be squared across its surface at the point marked. Either a try-square or a framing square is used for this purpose, depending upon the width of the board.

Try-squares consist of two parts, the handle and the blade, riveted together to form a right angle. Try-squares are made in different sizes and on most of them the inch scale is marked on the blade.

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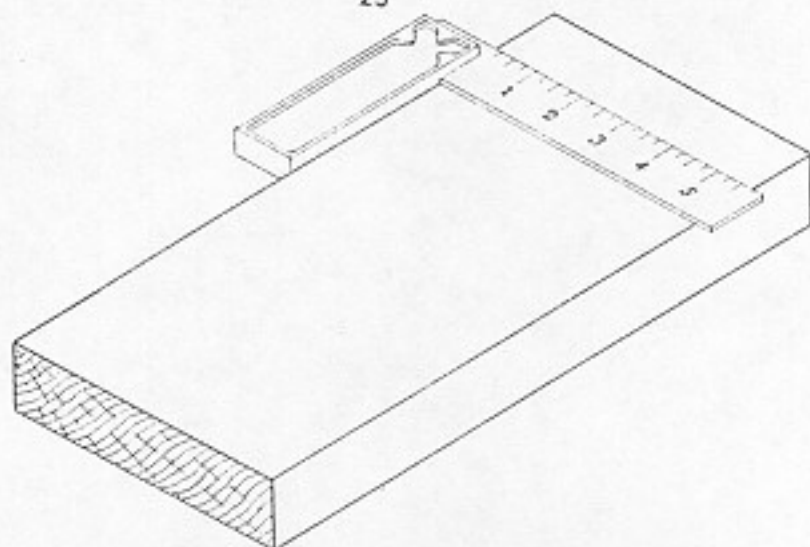


Fig. 39. Squaring a line across a board with a try-square. Handle of square held firmly against edge of board.

1. The handle of the try-square is held in the left hand, it is pressed against the edge of the board, and a line is marked along its blade with a pencil (Fig. 39). If a framing square is used, its longest part, the blade, is held against the edge, and a line is marked along its shortest part, the tongue (Fig. 40). When the boards are more than 14 in. wide, the position of the square is reversed.

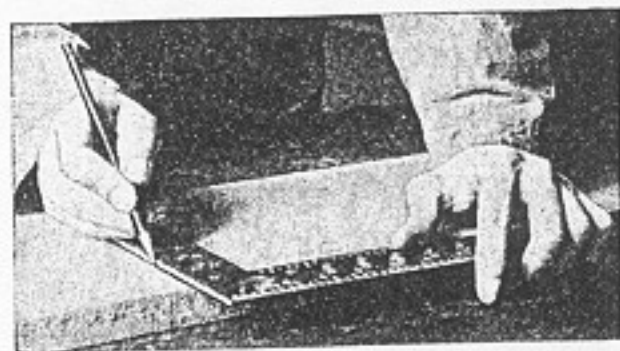


Fig. 40. Squaring a line across a board with a framing square.

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2. For accurate sawing or planing to finish dimensions, it is necessary to square a line all around the board; that is, on both sides and both edges.

3. A line is squared from the working edge across the working face, holding the handle of the square firmly against the edge (Fig. 39). (See Planing Job 45.)

4. Lines are squared from the working face across both edges, holding the handle of the square firmly against the working face (Fig. 41).

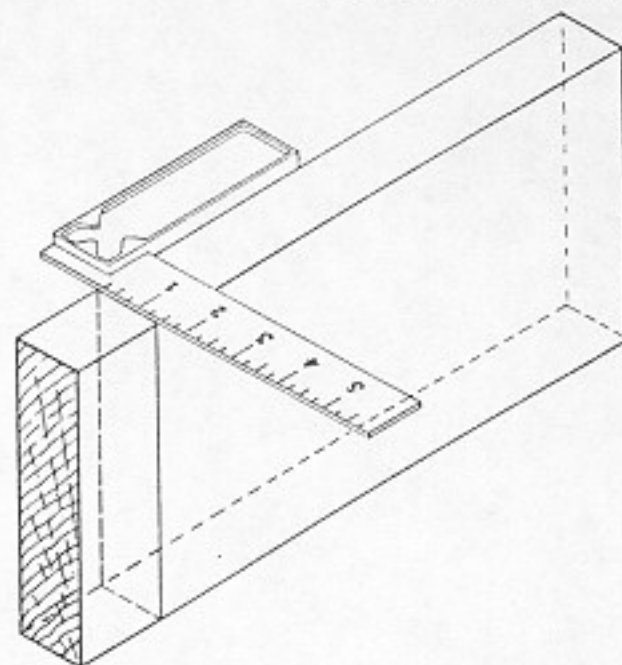


Fig. 41. Squaring a line all around a board with a try-square. Handle of square held against face of board.

5. The last line is squared from the working edge across the side opposite the working face.

QUESTIONS

1. What is the purpose of squaring lines all around a board?
2. What may be the reason if the first and last lines squared do not meet?

Gauging. By gauging is understood the marking of lines parallel to a surface, edge, or end of a board. This may be done with a marking gauge or with a pencil.

13. Gauging with a Marking Gauge. Marking gauges are made either of wood or steel. They consist of a bar on which a block or head slides. This head can be fastened to the bar with a setscrew at any point. The bar is graduated in 16ths of an inch and has a steel point or spur on one end.

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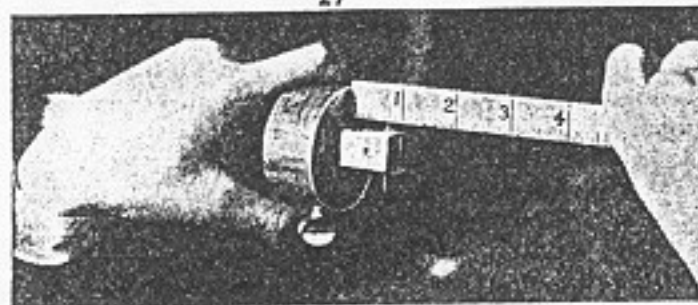


Fig. 42. Setting marking gauge accurately by measuring between block and spur.

1. The head is fastened to the bar at the desired point on the scale. As the spur in time works loose or becomes bent, it is best to check the measurement from the head to the spur with a rule (Fig. 42).

2. The marking gauge is held firmly in the right hand, the head is pressed against the edge of the board to be marked, the gauge is tipped forward until the spur just touches the wood, and a line is marked by moving the gauge away from the worker (Fig. 43). It is important that the spur takes hold gradually, that it is sharp, and that it does not project too far.

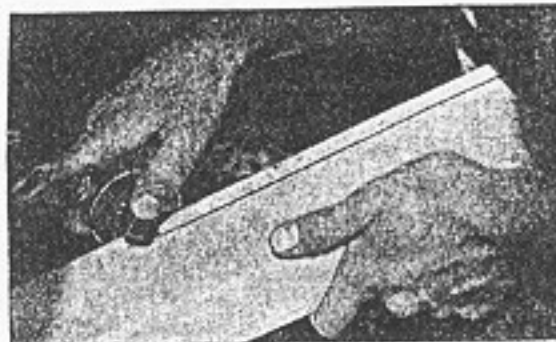


Fig. 43. Gauging with a marking gauge.

QUESTIONS

1. What is understood by gauging a line, and how may it be done?
2. What are the principal parts of a marking gauge?
3. How is a marking gauge adjusted accurately to a given distance?

14. Gauging with a Mortise Gauge. A mortise gauge differs from a marking gauge in that it has two spurs instead of one, and therefore can mark two lines at the same time. In the common types of mortise

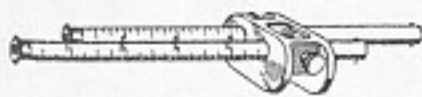


Fig. 44. Metal mortise gauge.

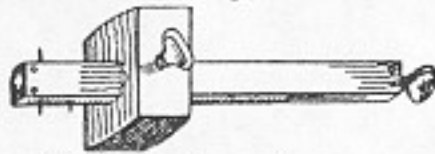


Fig. 45. Wooden mortise gauge.

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gauges, one spur is fixed and the other one movable by means of a screw inside the bar. On the other side of the bar the gauge has just a single point like an ordinary marking gauge (Figs. 44 and 45).

1. The two spurs are set to the distance required, and then the head is set with reference to the adjustable spur. The mortise gauge is manipulated in the same manner as the marking gauge. It is used especially for gauging the width of mortises and the thickness of tenons (Art. 92).

QUESTIONS

1. How does a mortise gauge differ from a marking gauge?
2. Can a mortise be gauged with an ordinary marking gauge? If so, how?
3. What happens if the spur of a gauge does not take hold gradually?

15. Gauging with a Pencil. Sometimes it is more convenient to gauge with a pencil point than with a steel point, for example, when laying out a chamfer (Planing Operation 38).

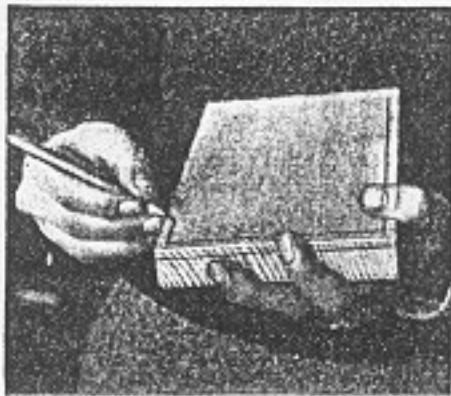


Fig. 46. Gauging with a pencil.

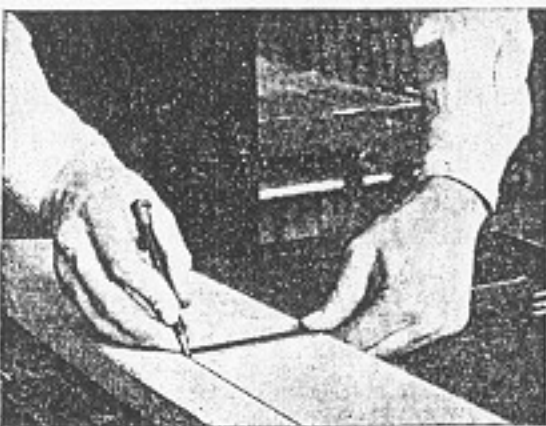


Fig. 47. Gauging with pencil and rule.

1. The pencil is held between the thumb and the second and third fingers, so that the third finger is held against the wood and acts as the head of a marking gauge. The line may be gauged either away from the worker or toward him (Fig. 46). This method can be used only for distances less than 1 in. and on boards having a smooth edge.

2. When a greater distance is to be gauged with a pencil, a rule is held in the left hand and a pencil in the right hand at the end of the rule (Fig. 47). The second finger of the hand holding the rule is held against the edge of the board. This finger acts as the head of a marking gauge. The gauging is done toward the worker moving both hands in unison. This method is used only on boards having straight and smooth edges.

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QUESTIONS

1. Why are lines sometimes gauged with a pencil rather than with a marking gauge?
2. Why should pencil gauging only be done on planed boards?

16. Drawing Arcs with Dividers, Compasses, or Trammel Points. A circle is a geometrical figure bounded by a curved line, called the *circumference*, which is equally distant from a point called the *center*. Any straight line from the center to the circumference is called a *radius*. A straight line through the center from one side of the circumference to the other is called the *diameter*. The diameter is equal in length to two radii. An *arc* is a part of a circle. A curved line is often a combination of arcs with different radii and different centers.

1. When a square corner is to be rounded, such as the top of a taboret or a table, the arc must be drawn in such a way that it touches both edges of the corner. This is done as follows:

2. The radius is measured from the corner along both edges, and

lines are squared from these points. The point where these lines intersect is the center.

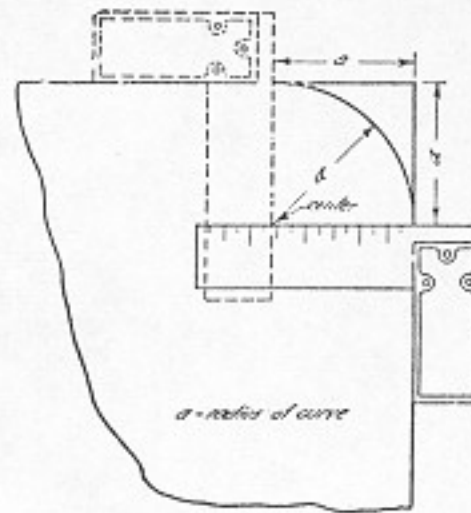


Fig. 48. Laying out rounded corners.

3. A pair of dividers or compasses is adjusted to the required radius, and the arc is drawn (Fig. 48). A pair of dividers may be made into a pair of compasses by attaching a pencil holder to one of its legs.

4. If an arc is to be drawn connecting two other arcs, or an arc and a straight line, its center will have to be found by experiment.

5. The compasses are adjusted to the given radius, and the pencil point is placed on one of the arcs at the place where it is connected. The steel point is placed where the center should

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be, and a light trial arc is drawn. It must be noted which way the center ought to be moved to make the three lines meet, but the center should not be changed before returning the compass to the first position. A second and a third trial is made if necessary, but the first position always is returned to when locating a new center (Fig. 49).

6. The board is clamped to the bench top when the center lies outside the board, and the center is located as explained in step 5.

7. A pair of trammel points consists of two steel points which can be clamped to a stick of wood. One of the points has an attachment for a pencil (Fig. 50). Trammel points are used for drawing circles or arcs having larger radii. A pair of trammel points may be made from a stick of wood and two nails. The radius required is measured and the nails are driven through the stick at these points. One nail point is placed in the center, and the arc or circle is drawn with the other. Trammel points are very accurate and always should be used in preference to a nail, a string, and a pencil.

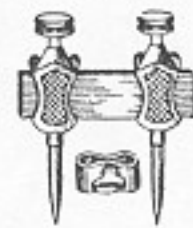


Fig. 50. Trammel points.

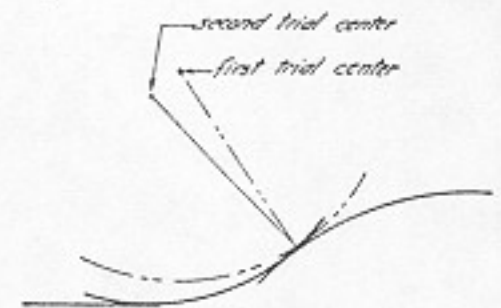


Fig. 49. Drawing arc connecting straight and curved lines.

QUESTIONS

1. What is the meaning of the following terms: circle; circumference; arc; center; radius; diameter?
2. What is the difference between the following tools: compasses; dividers; trammel points.
3. How could you quickly make a pair of serviceable trammel points?
4. Why are trammel points more accurate than string and pencil?

17. Drawing an Ellipse. An ellipse or oval is a geometrical figure frequently used in cabinetmaking. It has two axes of different lengths and at right angles to each other.

1. The axes of the ellipse are drawn. A nail is driven through one end of a small stick a little longer than half of the longest axis. Distances from this nail equal to half the short axis and half the long

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axis are measured, and nails are driven through the stick at these points.

2. Small cleats are nailed on the upper side of the long axis and on

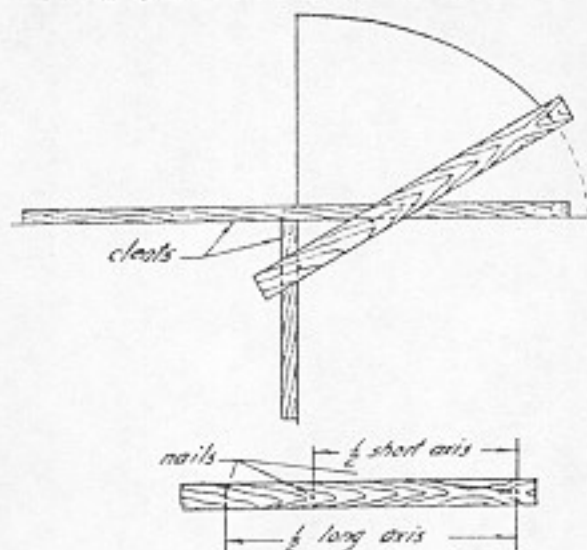


Fig. 51. Method of drawing ellipse.

the left side of the short axis. The two nail points nearest each other are held so that they are always in contact with these cleats, and the stick is moved through one fourth of the ellipse. The outline is scratched with the nail first driven (Fig. 51).

3. The small cleat is changed to the right side of the axis and half of the ellipse is completed. The other half is drawn in the same way.

18. Drawing an Arc Without a Radius. 1. It is occasionally necessary to draw a flat arc, which would have a very long radius. Such a radius usually is very difficult to find and even more difficult to use in drawing the arc.

2. The easiest way to do this job is to locate three points through which the arc must be drawn, and then a light board or a piece of plywood is cut so that it touches all three points (Fig. 52).

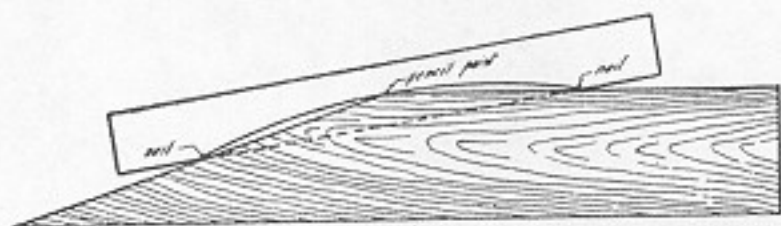


Fig. 52. Locating three points through which an arc is drawn.

3. A nail is driven at each end of the arc and a pencil is placed at the center. The board then is moved to one side, holding its edges against the two nails, and then to the other side. The pencil is moved along with the board, and draws a perfect arc.

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QUESTIONS

1. How does an ellipse differ from a circle?
2. How can an ellipse be drawn with trammel points?

19. Drawing a Polygon. A polygon is a geometrical figure bounded by three or more straight lines. In a regular polygon all the sides and all the angles are equal. The polygons most commonly used in wood-working are the triangle, the square, the hexagon (6 sides), and the octagon (8 sides).

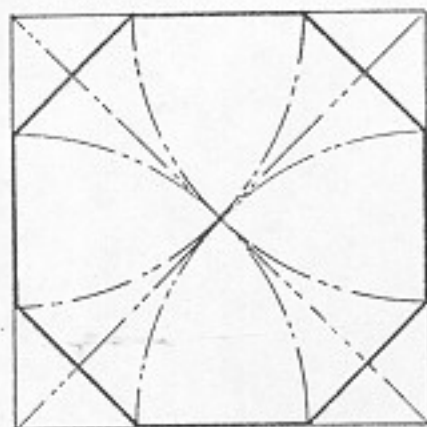


Fig. 53. Constructing an octagon from a square.

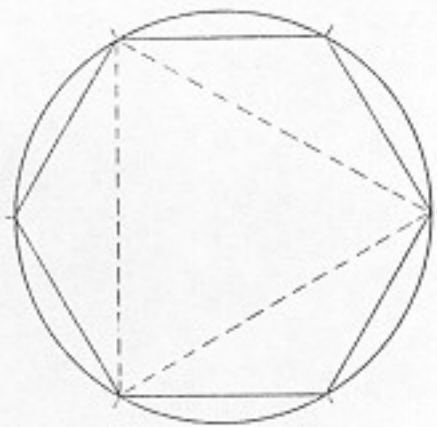


Fig. 54. Inscribing a hexagon in a circle.

1. A square can easily be laid out with a try-square or a framing

square. An edge is planed, the side of the square is laid out on this, and then lines are squared across the board at these points. The side of the square is laid out on these lines and is connected with a third line.

2. An octagon can be constructed from a square by striking arcs with each corner of the square as a center and half the diagonal as a radius. Connecting the ends of these arcs with a straight line across the corners of the square completes the figure (Fig. 53).

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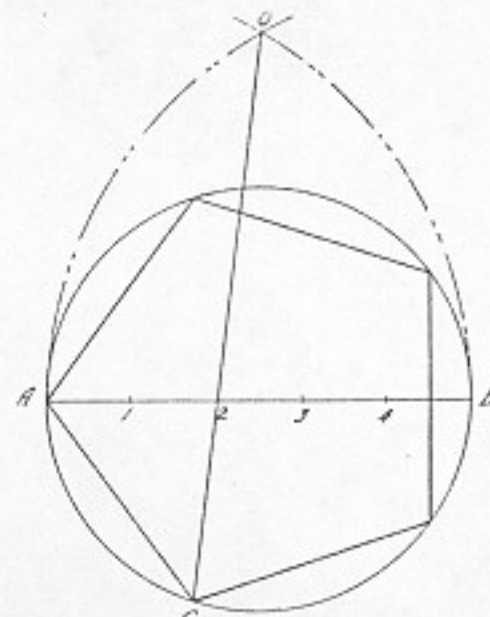


Fig. 55. Constructing a regular polygon with any number of sides.

3. A hexagon can be inscribed in a circle by stepping off the radius six times around the circumference and connecting these points with straight lines. A triangle is produced by connecting every other point (Fig. 54).

4. A triangle with sides of equal length can be constructed by drawing the base, using this as a radius, and drawing two arcs from each end of the base. Where these arcs intersect is found the third point of the triangle.

5. A regular polygon of any number of sides may be inscribed in a circle by drawing the diameter of the circle and dividing it into the same number of parts as the polygon has sides. Taking the diameter as a radius and

points A and B as centers, two arcs are drawn intersecting in point O (Fig. 55). From this point a straight line is drawn through the second division point on the diameter intersecting the circle at point C. Line AC is the side of the polygon, and can be stepped off around the circumference.

QUESTION

1. Can an octagon be constructed by the same method as a decagon (10-sided figure)?

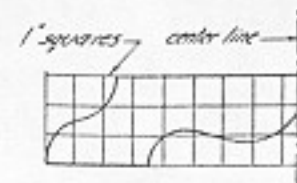


Fig. 56. Template of symmetrical curve.

20. Making Templates. Templates are full-sized patterns made of cardboard or thin wood. Usually patterns must be made of curved parts, which are sometimes difficult or impossible to lay out with a compass. When curves are symmetrical, that is, the same on both sides of a center line, a template need only be made for half the curve.

Furniture designers draw complex curves freehand, and crisscross them with 1- or 1/2-in. squares. In reconstructing such curves full size, the squares are first drawn full size, and then the points where the

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curve intersects the lines of the squares are located and marked from the drawing. The curved line is reproduced by connecting these points (Fig. 56). The waste material is then cut away and the template worked to the line.

QUESTION

1. A template is a used for laying out
2. What is the usual method of constructing a template from a drawing?
3. Templates for woodwork are made from

21. Laying Out Angles from a Framing Square. It is often necessary for the woodworker to lay out a certain angle. Angles most commonly used are 15, 22 1/2, 30, 45, 60, and 75 deg. All angles can be laid

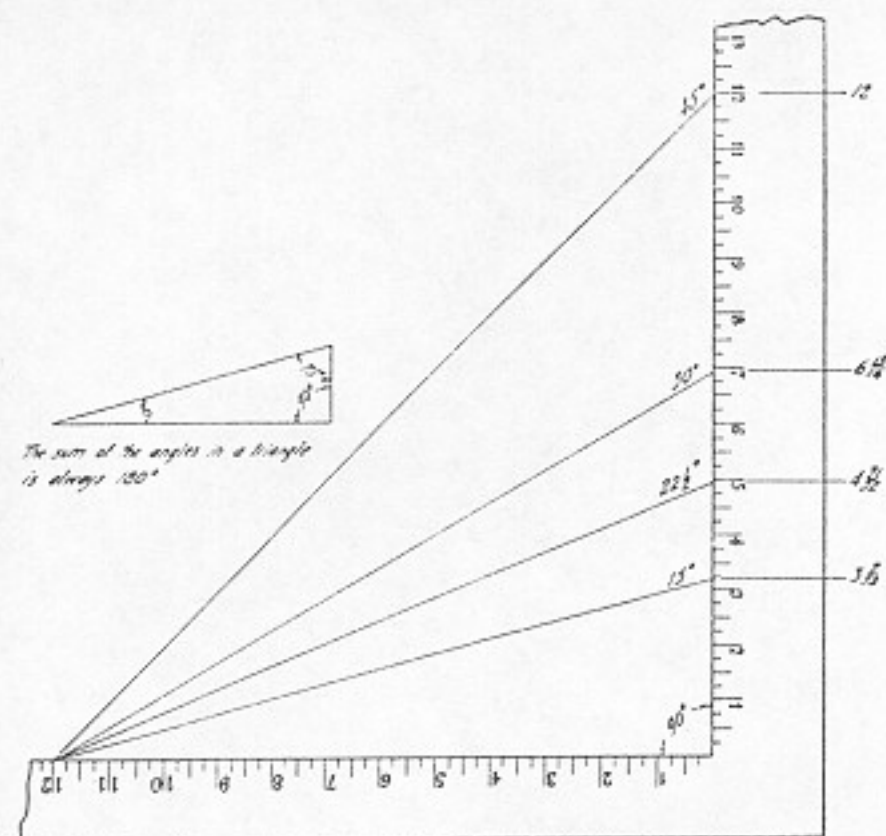


Fig. 57. Obtaining angles from a framing square.

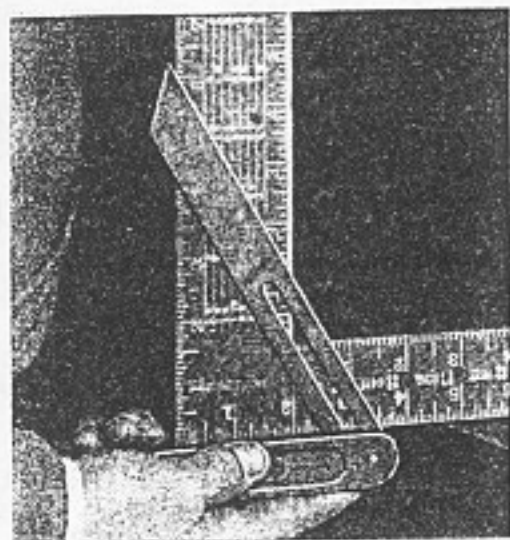


Fig. 58. Setting sliding T bevel to numbers on a framing square.

QUESTIONS

1. How can an angle of 60 deg. be laid out with a framing square?
2. What other tool is often used with the framing square in laying out angles?

22. Laying out Duplicate Parts. The accurate laying out of duplicate parts is essential to producing good work. The following points should be checked:

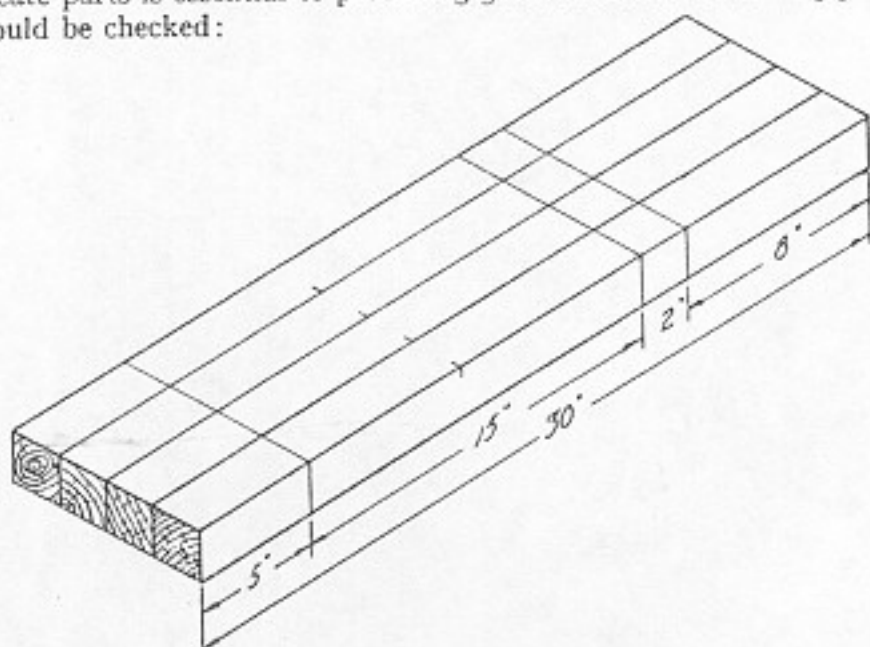


Fig. 59. Laying out measurements on duplicate parts.

1. As far as possible duplicate parts always are laid out at the same time, both for the sake of accuracy and economy of labor.
2. Measurements are laid out from one point if possible, and are checked by adding up various dimensions.
3. Measurements laid out on one member are transferred to the other members by placing them side by side and squaring lines across (Fig. 59).
4. All faces, edges, and ends from which measurements are to be laid out or gauged are plainly marked.
5. All gauging is done at the same time with the same setting of the gauge.
6. When using templates, they are placed correctly along center lines or edges and are held firmly while marking curves. Two or more pieces having the same curve are nailed together on the waste side of the line so that they may be sawed at the same time. The curve is marked only on the upper piece.

QUESTIONS

1. What are the advantages of laying out duplicate parts at the same time?
2. What would be the best way of laying out the length and other measurements on four table legs?

Chapter III

SAWING OPERATIONS

24. Crosscutting on Sawhorses.
25. Crosscutting in Bench Vise.
26. Ripping on Sawhorses.
27. Ripping in Bench Vise.
28. Sawing with Backsaw using Bench Hook.
29. Sawing with Backsaw using Bench Vise.
30. Sawing with a Turning Saw.
31. Sawing with a Coping Saw.
32. Sawing with a Compass or Keyhole Saw.

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Chapter III

SAWING OPERATIONS

A crosscut saw consists of a flexible-steel blade with a cutting edge from 18 to 26 in. long, to which a wooden handle is bolted. The saw blade is made wider at the handle than at the toe to give it more stiffness and to prevent buckling when it is pushed through the wood.



Fig. 62. Teeth of a crosscut saw.



Fig. 64. Crosscutting on a sawhorse. Note position of thumb on left hand.

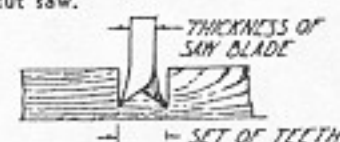


Fig. 63. Set of teeth showing clearance of saw blade.

Crosscut saws cut on the pushing stroke. A crosscut saw may be easily recognized because the teeth are beveled on one side. These bevels form a series of knife points which cut smoothly across the fibers of wood; that is, across the grain (Fig. 62). The teeth are also bent out to alternate sides to

make the cut or "kerf" wider than the thickness of the saw blade, thereby preventing it from binding. This is called "set" (Fig. 63). (See also Sharpening Operation 1, steps 5 to 8.)

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24. Crosscutting on Sawhorses. 1. The board to be cut is laid on two sawhorses, the length to be cut off is measured, and a line is squared across the board, using a pencil and a large try-square or a framing square (Fig. 40).

2. The end to be cut off is placed outside one of the sawhorses and the board is held firmly by putting one knee on it (Fig. 64).

3. The cut is started on the waste side of the line. The thumb is used as a guide for the saw, raising it slightly from the board to avoid being cut if the saw should get out of control. Sawing is begun by taking a few short strokes. Then, when the saw cut has been well started, sawing is continued with long, even strokes, using the whole length of the saw. To practice the cutting the saw may be moved slowly back and forth without pushing on it. As control is gained over the saw, more force may gradually be put on the pushing strokes, but sawing must be continued slowly. The sawing must be done as close to the line as possible without sawing away any part of it. The side of the saw is held perpendicular to the board and the cutting edge at an angle of about 45 deg.

4. When the board is almost cut through, the length and force of the strokes are decreased, and the piece that is being cut off is supported to prevent splitting. If it is a large piece, somebody must hold it.

5. Some prefer to hold the saw handle with four fingers, as shown in Figure 65, while others extend the index finger along the handle in order to better guide the saw (Fig. 67).

25. Crosscutting in Bench Vise. A short board may also be crosscut in a bench vise. In this case it should always be clamped flat in the vise and never on edge (Fig. 65). If placed on edge the saw cannot be held at the proper angle. It comes in contact with too small a portion of the wood at a time. This causes the saw to jerk and chatter.

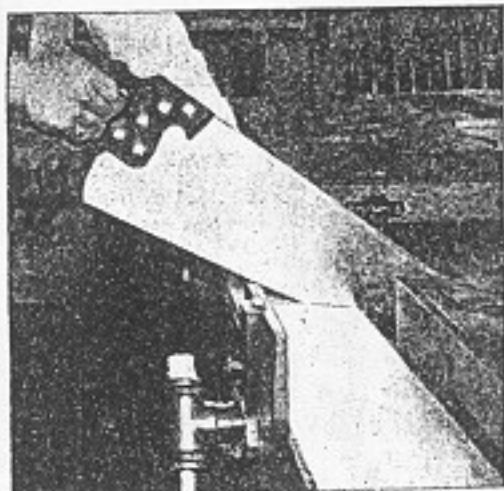


Fig. 65. Crosscutting in a bench vise.

QUESTIONS

1. How will a saw work when it has not sufficient "set"?
2. Why is the part of a board to be sawed off placed outside the sawhorses?
3. Why should a board always be placed flat when crosscutting?

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A rip saw resembles a crosscut saw, but its teeth are filed straight across and look like a series of narrow chisel points. The front part of

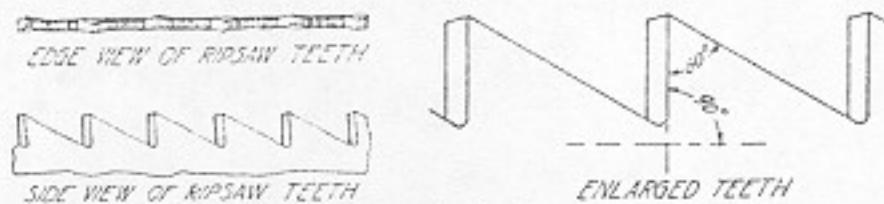


Fig. 66. Teeth of a rip saw.

each tooth is at right angles to the cutting edge of the saw (Fig. 66). The rip saw should be used only for cutting with the grain of the wood. When used for crosscutting, it makes a rough cut. A crosscut saw can be used for ripping, but it cuts more slowly than a rip saw. The teeth of a rip saw must be set in the same way as those of a crosscut saw.

26. Ripping on Sawhorses. 1. The line along which the board is to be ripped is laid out. This line may be marked with a marking gauge or a pencil if the edge of the board is planed (Laying-Out Operations 13 and 15). If the edge is rough, the width to which the board is to be ripped is measured at two or more points, and a line is drawn through these points along the edge of a framing square or other straightedge.

2. The end of the board projects over one of the sawhorses when starting the cut, and one knee is placed on the board to hold it steady.

The sawing is done on the waste side of the line which is followed as closely as possible without cutting away any part of it.



Fig. 67. Ripping a board on sawhorses. A wedge is driven into the saw kerf to keep it open.

3. As the cut progresses, the sawhorse is moved to the end of the board and the sawing is continued between the two sawhorses (Fig. 67).

4. Although the saw may be in perfect condition, it will bind in some boards which are in a springy condition due to uneven drying. In such a case the saw kerf is kept open by driving a wedge into it (Fig. 67).

5. Small boards are cut on one sawhorse by cutting halfway through from each end. The saw is held at an angle of about 60 deg. with the horizontal when ripping.

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QUESTIONS

1. Why is it that ripping can be done between two sawhorses, but not crosscutting?
2. How should the saw be held when ripping?

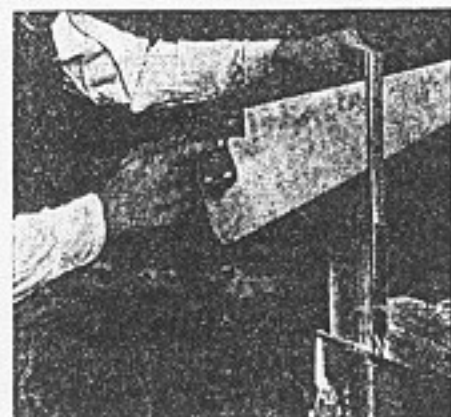


Fig. 68. The try-square is placed on the vise jaw to get the wood plumb. It should not remain there during the sawing process.

27. Ripping in a Bench Vise.

1. Short pieces of stock are most conveniently ripped in a bench vise. The piece is clamped so that it is perpendicular or plumb. This is done by placing the handle of a try-square on the vise jaw and its blade against the edge of the piece to be sawed (Fig. 68). This makes it much easier to follow the line.

2. To avoid cutting into the bench top or dulling the saw on the iron vise, a piece of wood is placed on the bench top directly behind the board being ripped.

3. The saw is started on the waste side of the line. Although the correct sawing angle is about 60 deg., it is more convenient in this case to hold the saw nearly horizontal and steady the board with the other hand (Fig. 68). This tends to prevent chattering.

4. The ripping is completed either by reversing the board in the vise and sawing from the opposite end, or by clamping it so that the saw cut is continued outside the end of the bench.

5. Another way to rip a narrow board in a bench vise is to place it so that its edges are in contact with the vise jaws. The worker stands to the left of the bench, the board is clamped in the vise at an angle of about 60 deg., and it is steadied with the left



Fig. 69. Ripping in a bench vise.

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hand. The saw is held horizontally in the right hand. In this way the correct sawing angle is maintained (Fig. 69).

QUESTIONS

1. What precautions should be taken to avoid cutting into the bench top or vise when

- ripping in the bench vise?
2. Why is it easier to follow the line when the board is placed perpendicularly in the vise?
 3. How can a board be ripped in a bench vise at the correct sawing angle?

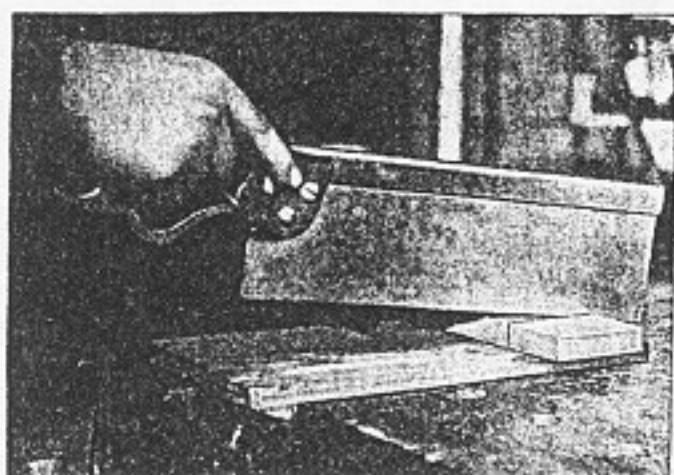


Fig. 70. Sawing with backsaw, starting the cut. Work held on bench hook.

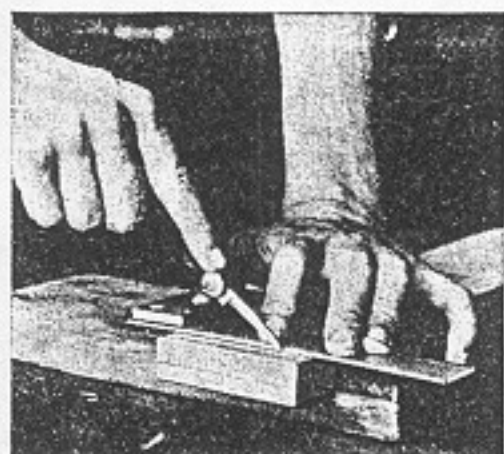


Fig. 71. Scoring line with knife.

A backsaw has teeth similar to those of a crosscut saw, but they are much smaller and finer. The blade is also thinner and for that reason must be stiffened with an iron back. The backsaw, therefore, makes a finer cut than the crosscut saw. It is used in making joints and in accurate cutting and fitting.

28. Sawing with Backsaw using Bench Hook. 1. A line is squared around the piece to be cut (Laying-Out Operation

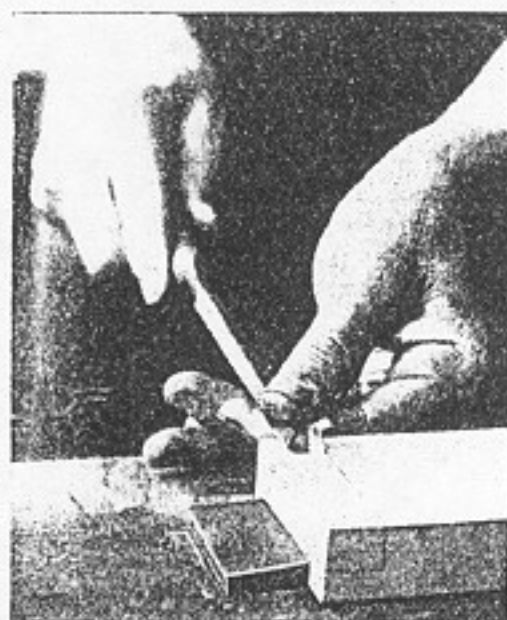


Fig. 72. Cutting triangular groove in which to start the saw.

12), and the piece is held firmly against the short crosspiece of the bench hook, so that the line marked comes just outside the end of the crosspiece (Fig. 70). If it is to be sawed all the way through, the teeth of the saw will not injure the bench top, but will only come in contact with the surface of the bench hook.

2. The thumb of the left hand is used as a guide for the saw. The cut is started on the far edge of the stock, with the heel of the saw raised as shown in Figure 70. As the cutting progresses, the saw is lowered little by little to a horizontal position.

29. Sawing with Backsaw using Bench Vise. 1. When crosscutting, the stock is clamped in the bench vise so that the saw cut falls outside the end of the bench.

2. To aid in getting a straight and accurate cut, a triangular groove is made with a knife and a chisel on the waste side of the line. It is easy to start the saw in such a groove (Figs. 71 and 72. See also Fig. 175).

3. The beginner may use a block nailed or clamped to the line as a guide for the backsaw (Fig. 73).

4. When cutting with the grain, as in making tenons, the wood is clamped in the vise as explained in Mortise-and-Tenon Joints, Article 92 (Fig. 245).

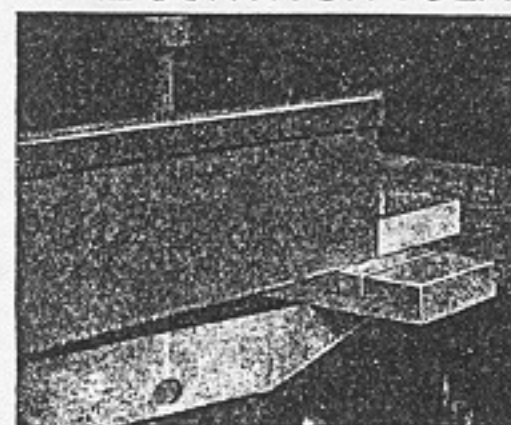


Fig. 73. Block hand-screwed to piece guiding backsaw.

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QUESTIONS

1. Why does a backsaw cut finer than an ordinary crosscut saw?
2. What are the advantages of a bench hook in sawing?
3. How can a backsaw be guided to make a straight cut?

30. Sawing with a Turning Saw. The turning saw consists of a narrow saw blade held under tension in a wooden frame. It is generally used for sawing outside curves on both light and heavy stock, but may also be used for inside work.

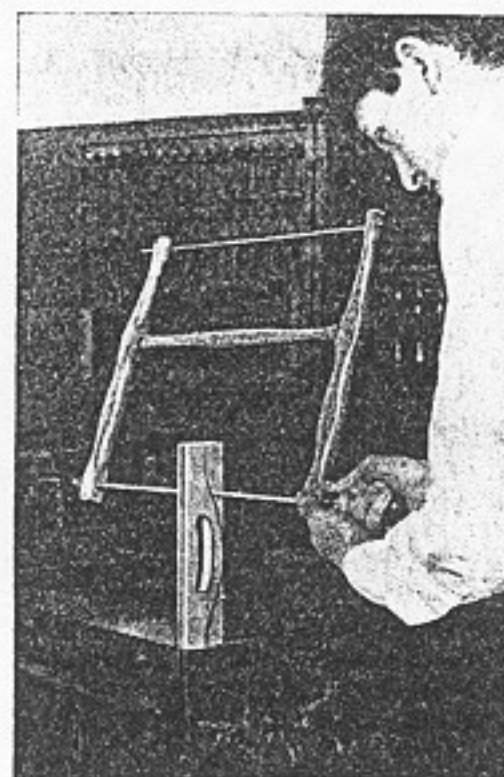


Fig. 74. Sawing with a turning saw.

1. The narrow blade, which has teeth like a rip saw, is brought under tension by tightening the bolt or twisting the cord at the other end of the frame.

2. The work is clamped in a bench vise and the saw is gripped with both hands held close together on the handle (Fig. 74). The blade may be turned in the frame if necessary to follow the line. The teeth should point away from the operator.

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31. Sawing with a Coping Saw. The coping saw is like a small turning saw. Its fine blade is brought under tension by the spring in the steel frame. In some saws this is done by bending the frame together

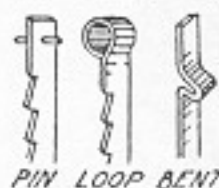


Fig. 75. Ends of coping-saw blades.

while inserting the saw, in others by turning the handle which has an adjustment screw. There are two kinds of coping-saw blades, those with a pin through each end and those in which the ends are bent into loops (Fig. 75). There are many grades of coping-saw blades on the market. It pays to buy the best.

1. The coping saw is used on thin stock for both outside and inside curves. If the work is clamped in a bench vise, the coping saw is held horizontally like a turning saw with the teeth pointing away from the handle (Fig. 76).

2. When a saw bracket is used, the saw is held in a vertical position with the teeth pointing down toward the handle (Fig. 77). Drawing the saw blade

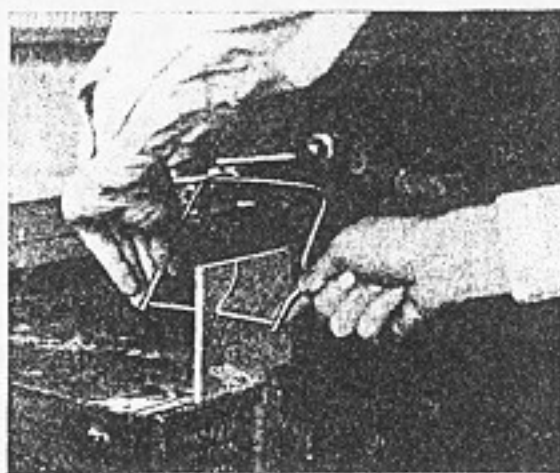


Fig. 76. Sawing with a coping saw, work held in a bench vise.

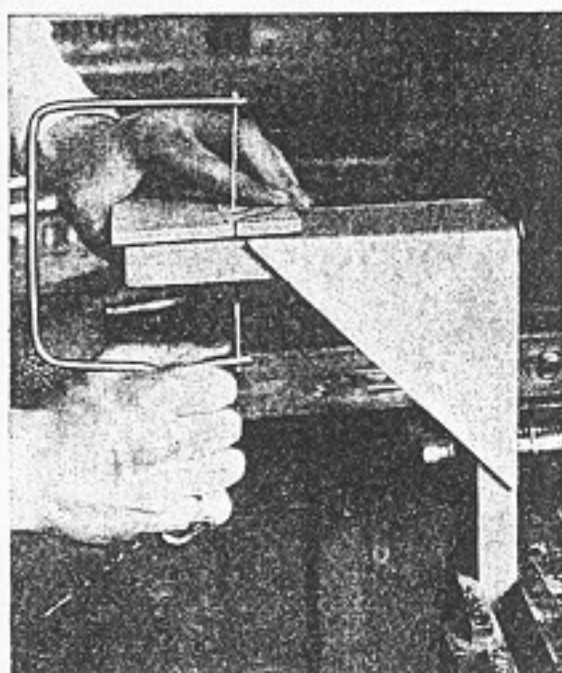


Fig. 77. Sawing with a coping saw, work held on a saw bracket.

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through a piece of beeswax at intervals makes the cutting easier and decreases the number of breakages.

3. All inside cutting (fretwork) with the coping saw is done as follows: A small hole is bored through the wood with a twist bit and the saw blade is inserted through this. The blade is then brought under tension in the usual way.

32. Sawing with a Compass or Keyhole Saw. The compass saw is like a small rip saw with a short, narrow blade. The keyhole saw is like the compass saw, but its blade is narrower. These two saws are used principally for sawing inside curves in heavier stock.

1. The work to be sawed is clamped in a bench vise. One or more holes, large enough to admit the point of the saw, are then bored with an auger bit. Some-

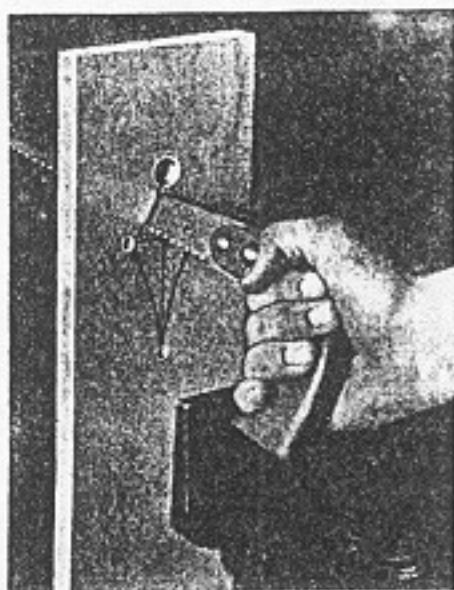


Fig. 78. Sawing with a compass or keyhole saw.

times the hole may be bored so that it forms part of the design (Fig. 78).

QUESTIONS

- Which saw should be used for each of the following operations:
 - Sawing a circular hole, 5 in. in diameter in a 1-in. board?
 - Sawing out a circular table top, $\frac{3}{4}$ -in. thick and 18 in. in diameter?

c) Sawing a curved outline in $\frac{1}{4}$ -in. stock?

d) Sawing a fretwork pattern?

2. How should the teeth of a turning saw point with reference to the hand?

3. How should the teeth of a coping saw point (a) when the work is held in a bench vise? (b) when the work is held on a saw bracket?

Chapter IV

PLANING OPERATIONS

- Adjusting a Jack Plane.
- Planing a Surface (Warped Board and Board "in Wind")
- Planing an Edge.
- Jointing Two Edges for Gluing.
- Planing Bevels and Chamfers.
- Planing End Grain.
- Planing Curved Edges with a Circular Plane.
- Planing Curved Edges with a Spokeshave.
- Smoothing Flat Surfaces with a Cabinet Scraper.
- Smoothing with a Hand Scraper.

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Chapter IV

PLANING OPERATIONS

Planes are made both of wood and iron, but iron planes are used most in this country. Planes differ a great deal in their use and construction. Those used for planing surfaces straight, flat, and smooth are constructed exactly alike, but are made in various lengths and widths. The most common are:

The smooth plane, from 5½ to 10 in. long with cutters from 1¼ to 2¾ in. wide, which is used for finishing off uneven surfaces and for planing small pieces (Fig. 81).

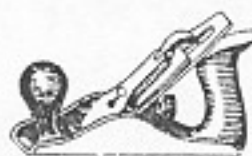


Fig. 81. Smooth plane.

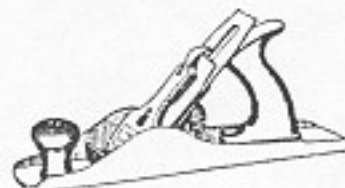


Fig. 82. Jack plane.

The jack plane, from 11½ to 15 in. long with cutters from 1¾ to 2¼ in. wide, which is an all-round tool and is used for most planing jobs in the shop (Fig. 82).

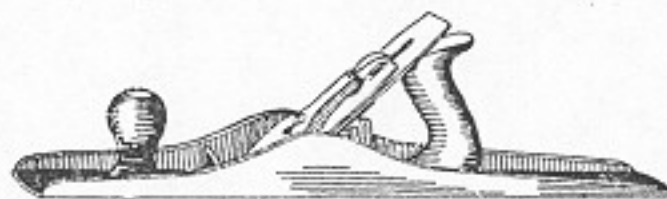


Fig. 83. Jointer plane.

The fore plane, 18 in. long with a cutter 2¾ in. wide, which is used for planing larger surfaces, such as table tops, legs for tables and cabinets, and edges of boards to be glued.

The jointer plane, from 22 to 24 in. long with cutters from 2¾ to 2½ in. wide, which is used for planing the longest surfaces and edges on doors and large pieces of furniture (Fig. 83).

34. Adjusting a Jack Plane. 1. The sectional drawing of the plane, Figure 84, and its various parts, should be studied by the worker to see how each part fits and what it does.

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2. To take the plane iron out, the lever cap is removed first. This has a slot which fits over the lever-cap screw, and a lever or cam which tightens or loosens it. Slipping the thumb and index finger under this lever and bending it outward loosens the lever cap. Its purpose is to hold the plane iron firmly in place.

3. The plane iron is double, consisting of a *cutter iron* and a *plane-*

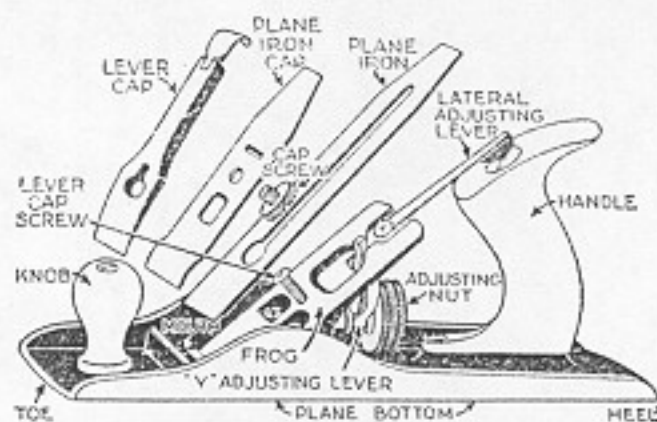


Fig. 84. Sectional drawing of a plane.

iron cap. The cutter has a bevel on one side and is flat on the other. To this flat side the cap iron is fastened with the cap screw. The cutter cuts the shavings, the plane-iron cap stiffens it and causes the shavings to curl. The cap screw is loosened with a screw driver, or with the lever cap used as a screw driver, and the two irons are taken apart.

4. The other parts of the plane are the iron casting or body, which has a slot in the bottom called the *throat* or *mouth* through which the shavings pass. To this casting is screwed the wooden knob and handle, which serve to hold and guide the plane, and another casting called the *frog*.

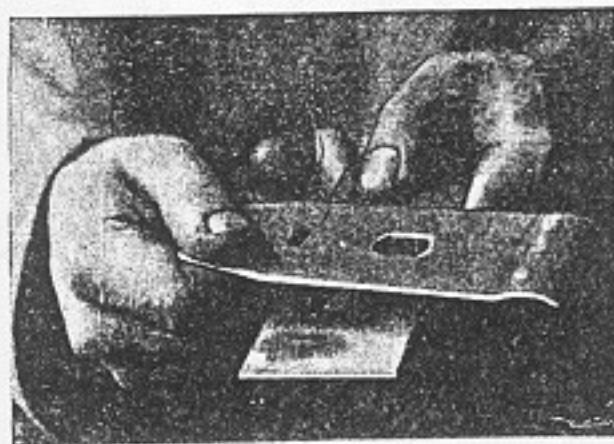


Fig. 85. Inserting cap screw into plane iron while holding the two irons at right angles to each other.

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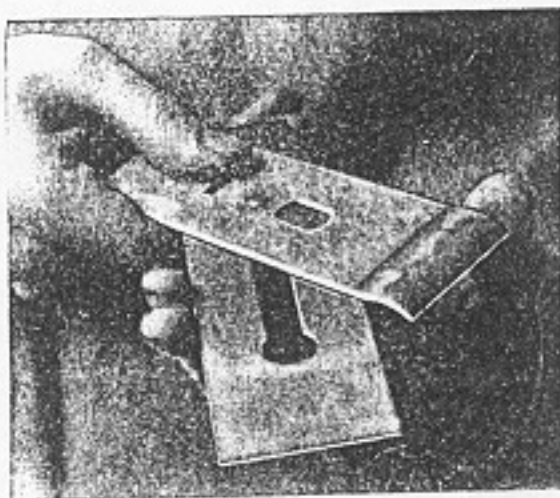


Fig. 86. After sliding the cap to the end of the slot, it is turned until its edges are even with those of the plane iron.

but at right angles to it and with the cap screw down (Fig. 85).

9. The head of the screw is dropped through the round hole in the plane iron, and the cap is slid to the end of the slot while still holding it at right angles to the plane iron.

10. It is now turned so that the sides of the two irons are even, and it is slid toward the cutting edge of the plane iron (Fig. 86). The edge of the cap should be from $1/32$ to $1/16$ in. away from the edge of the cutter.

11. The cap screw is tightened with the hand (Fig. 87), and is given an extra turn with a screw driver or the lever cap

Fig. 87. Turning the cap screw by hand to fasten the cap to the plane iron $1/16$ in. from its cutting edge.

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clamp is tightened. If it fits too loosely or too tightly, the lever-cap screw is tightened or loosened, as the case may be.

14. Holding the plane so that the knob is toward the worker, it is sighted along the bottom. The lateral-adjustment lever then is moved until the plane iron projects the same amount on both sides (Fig. 88).



Fig. 88. Sighting along bottom of plane.

15. A trial cut is made on a piece of waste wood, and the Y-adjustment nut is turned until the plane cuts a fine shaving.

QUESTIONS

1. What is the purpose of (a) the plane-iron cap, (b) the lever cap?
2. How may the throat of a jack plane be made wider or narrower?
3. How may the lever cap be tightened or loosened?
4. To which side of the cutter iron is the plane-iron cap fastened, and how far from the cutting edge?

35. Planing a Surface. 1. When a board is to be planed it is very important to know in which direction to plane. Planing against



Fig. 89. Opposite surfaces are planed in opposite directions.

the grain makes the surface rough, while planing with the grain (in the opposite direction) makes it smooth. The correct direction for planing can be found by observing the grain on the edge (Fig. 89). The lines of the grain can be compared

with the bristles of a brush. It can immediately be seen which way to stroke the brush with the bristles and which way against the bristles. Two opposite surfaces always are planed in opposite directions.

2. The board is clamped so that it rests flat on the bench and its ends are held securely between a bench stop and the vise dog (Fig. 90). The sides of a board never should be clamped in a vise, because when the vise is tightened the board will bend.

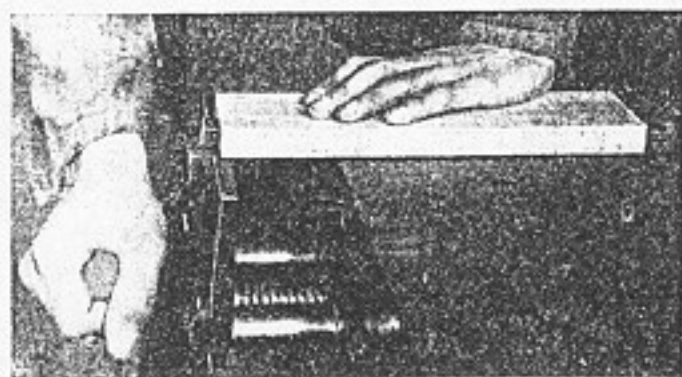


Fig. 90. Clamping a board for surface planing.

3. Before beginning to plane, the surface is tested for flatness with a try-square or a framing square. The square is placed across and along the grain, and also diagonally from corner to corner. It may be found that the surface is almost flat and only needs to be smoothed.

4. Light cuts are taken with the plane, pressing on the knob at the beginning of the stroke and on the handle at the end of the stroke. If possible, one continuous cut should be taken from one end of the board to the other. The board should be tested frequently for flatness with a try-square or a framing square (Figs. 91 and 114).

5. If the plane does not cut easily and smoothly, the cutter is either dull or set to cut too thick a shaving, or not level with the bottom of the plane. In the former case, waves or nicks appear across the grain. In the latter case, the plane leaves a streak after each stroke. If the mouth or throat of the plane fills up with shavings, it will be found

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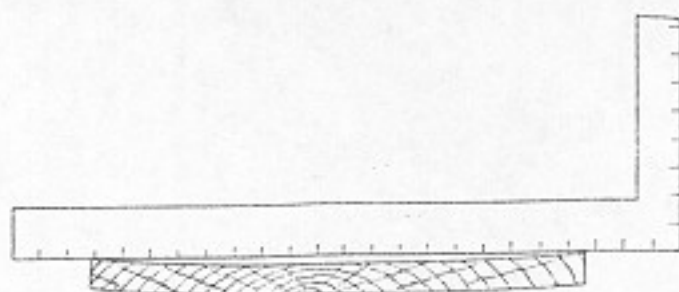


Fig. 91. Testing a warped board with a framing square.

when the plane is taken apart that shavings have entered between the cutter and the plane-iron cap. To make the cap fit closer against the cutter, it may be rubbed carefully on an oilstone, after which its edge should be bent like that of a cabinet scraper with a burnisher (see Sharpening Operation 4).

6. Planing a Warped Board. The surface also may be either hollow or round along the center. In this case the board is simply warped, and a little more must be taken off at the sides or in the middle, as the case may be (Fig. 91).

7. First, the sides of the board that are high are marked and leveled off. The board again is tested with the square, and when it is almost flat, the entire surface is smoothed.

8. If the grain tears up, the board is reversed so that the planing is done in the opposite direction.

9. If the grain tears up in places that were smooth before, the board is cross-



Fig. 92. Sighting a board "in wind."

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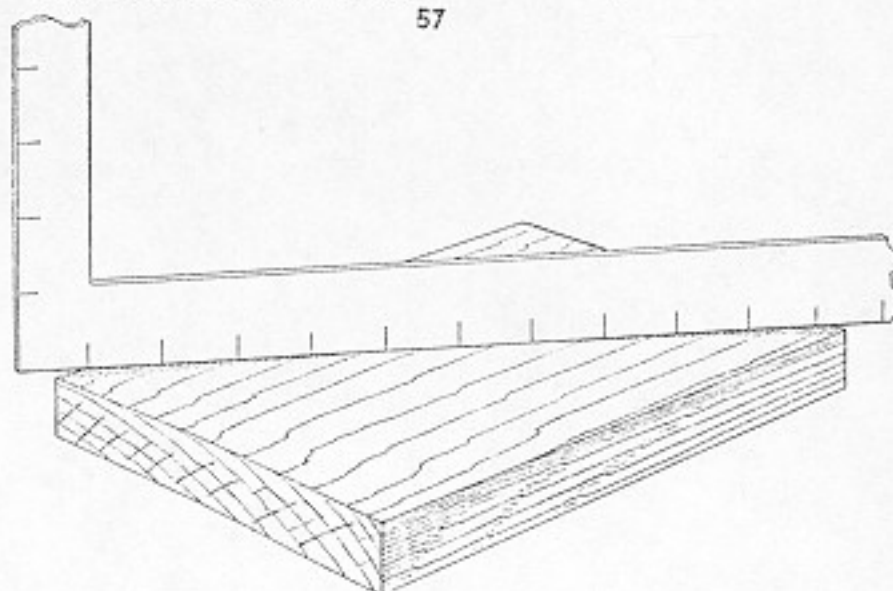


Fig. 93. Testing a board "in wind" with a steel square.

10. Planing a Board "in Wind." When a board is twisted or "in wind" as it is called, it is more difficult to plane it flat and true. This condition is easily recognized either by sighting the board (Fig. 92),

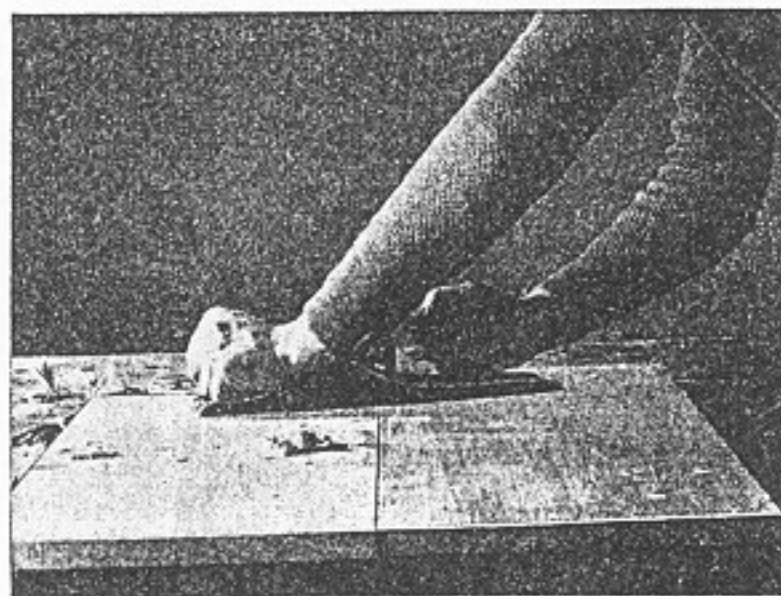


Fig. 94. Planing across the grain.

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or placing a steel square diagonally from corner to corner. In one direction it will touch the corners and not the middle; in the other direction it will touch the middle of the board and not the corners (Fig.

93). In other words, two corners of the board are high and two are low.

11. A board in wind is planed diagonally from one high corner toward the other. When it is flat, it is planed along the grain or smoothed with a scraper.

12. If a surface is made up of several boards glued together with the grain running in opposite directions, it is advisable to plane across the grain until it is flat and true (Fig. 94) and then finish with a cabinet scraper (Fig. 110, Art. 42).

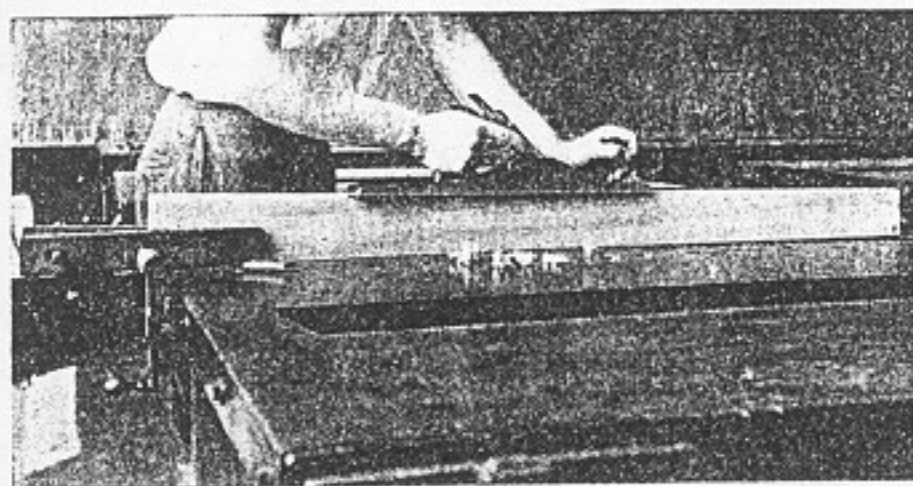


Fig. 95. Planing edge of a long board, one end held in vise, the other supported by a hand screw.

QUESTIONS

1. Why should a surface be tested for flatness before planing?
2. What is the cause of the following conditions and how may they be remedied:
 - a) A streak or ridge shows along the surface after each stroke of the plane?
 - b) Waves or nicks appear across the grain?
 - c) The throat or mouth of the plane becomes clogged with shavings?
 - d) The grain tears up and the surface becomes rough?
3. What is the difference between a warped board and a board "in wind"?
4. How may a surface glued up of several boards be smoothed?

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Fig. 96. Planing an edge. Note way of holding plane.

36. Planing an Edge. 1. An edge is usually planed at right angles to the sides of a board. A short board may be clamped in the bench vise. A longer one can be held at one end in the vise, while its other end can be supported on the bench top with a hand screw clamped to it (Fig. 95).

2. When planing an edge, the thumb of the left hand is placed on the iron body of the plane right behind the knob, holding the other fingers on the bottom of the plane as a guide. In this way better control is had over the plane (Fig. 96).

3. The plane must not be held diagonally over the edge of the board, but the entire bottom must be brought in contact with the surface, otherwise the board will be hollow in the center.

4. The board is tested for straightness with a framing square or with the edge of the plane (Fig. 97). It is tested for squareness with a try-square (Figs. 98 and 115).

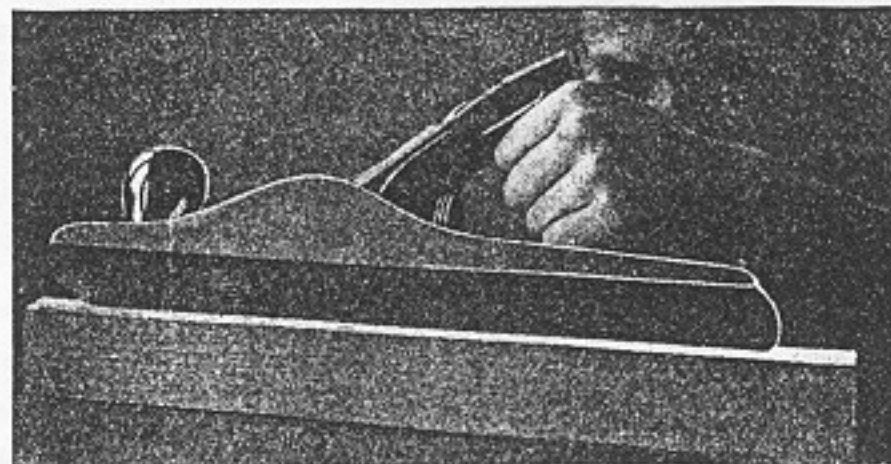


Fig. 97. Testing edge for straightness with plane.

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Fig. 98. Testing edge for squareness with try-square.

QUESTIONS

1. How may a long board be supported in the bench vise for edge planing?
2. How should the plane be held when planing edge grain?
3. What usually happens when an edge is planed with plane held diagonally across it?

37. Jointing Two Edges for Gluing. 1. When two edges are to be jointed for gluing, the best sides are selected for the faces and are marked. The faces usually are not planed until after the boards are glued.

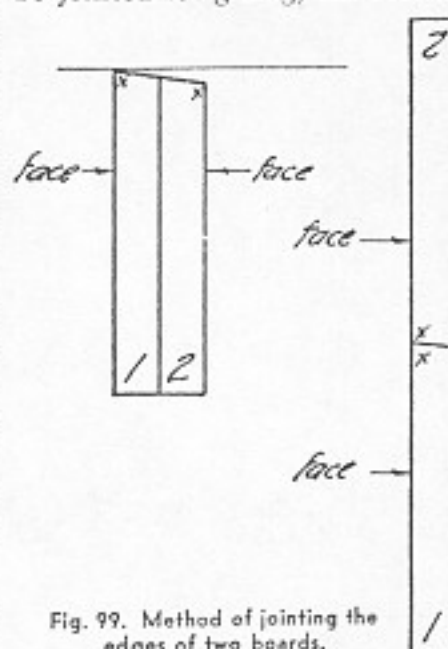


Fig. 99. Method of jointing the edges of two boards.

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2. The boards are clamped together in the bench vise with both faces out. The two edges are planed at the same time. In this way the angles of both are always equal even if they are not absolutely square to the sides. When one is placed on top of the other, the faces are always in line (Fig. 99).

3. The boards should make a good joint at both ends, because end wood dries faster and therefore shrinks and causes the joints to open at the ends. A slight hollow in the center just enough

for light to show through is to be preferred.

4. When the boards have been jointed correctly, a single clamp placed in the center should draw them up tightly. They should fit so tightly together at the ends that the boards cannot be moved by pressing on them with the fingers. This test always should be made before gluing (Fig. 100). At least three clamps are needed for gluing (see Gluing Operation 101).

QUESTIONS

1. Why is it easier to joint two edges at the same time instead of jointing one at a time?
2. When placing two jointed edges together, why is it best to have a fine opening

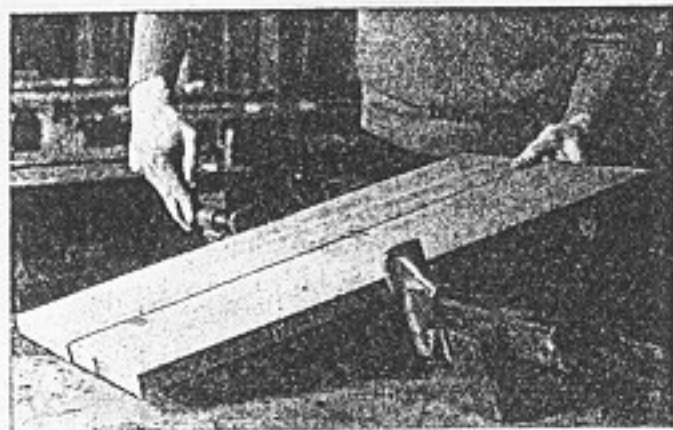


Fig. 100. Testing an edge-to-edge joint before gluing.

in the middle?

3. How can you tell if two jointed edges will make a good joint?

38. Planing Bevels and Chamfers. 1. A bevel is an edge which is planed at an angle other than a right angle to the face of a board.

2. To lay out a bevel, a sliding T-bevel is set to the angle desired. This is marked off on both ends of the board. A sliding T-bevel is simply a try-square adjustable to any angle.

3. With the plane held at this angle, the procedure is the same as when planing an edge. The bevel should be tested frequently with a T-bevel (Fig. 101).

4. A chamfer is formed when the sharp corner between two surfaces at right angles to each other is planed.

5. A chamfer often is planed at 45 deg., and in that case an equal width is marked on each adjoining surface. These lines are marked with a pencil and not with the steel point of a marking gauge (Laying-Out Operation 15).

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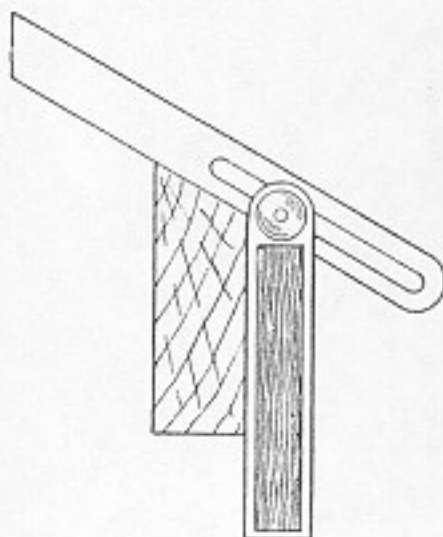


Fig. 101. Testing bevel with sliding T-bevel.



Fig. 102. Planing chamfer on end grain.

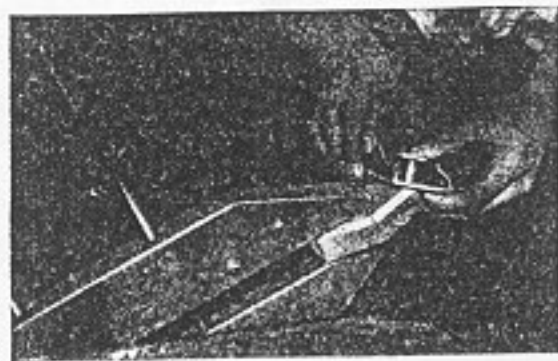


Fig. 103. Chamfering small piece of wood held in a hand screw.

stopped chamfer is made with a chisel (Chiseling Operation 50, step 3).

QUESTIONS

1. What does the cross section of a piece of wood look like which has one edge beveled

and the other chamfered?

2. Why should a chamfer be laid out with a pencil instead of with a marking gauge?

39. Planing End Grain. End grain may be planed in four different ways.

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Fig. 104. Planing end wood. Corner cut off to prevent splitting.

1. When the board is wide enough, it is planed part way from each edge.

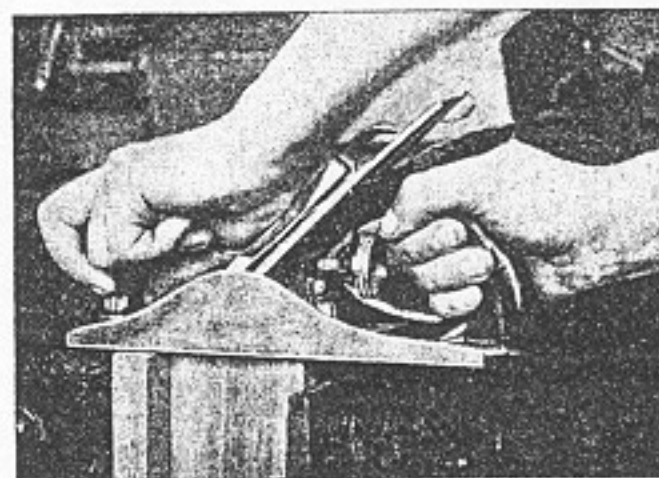


Fig. 105. Planing end of narrow board. Board placed behind it prevents splitting.

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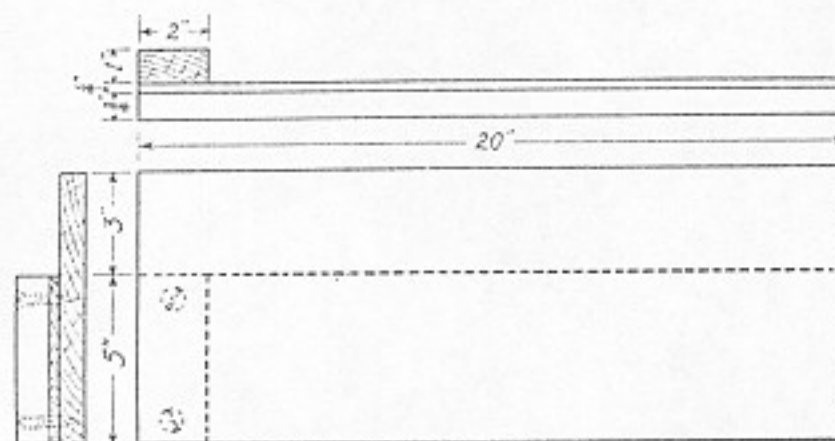


Fig. 106. Shooting board.

2. When the board is narrow, but still a little wider than needed, a corner is chiseled off and the end is planed right across this corner without splitting the wood (Fig. 104).

3. When the board is narrow and the right width, another board is placed behind it in the bench vise. This will prevent it from splitting while the end is planed (Fig. 105).

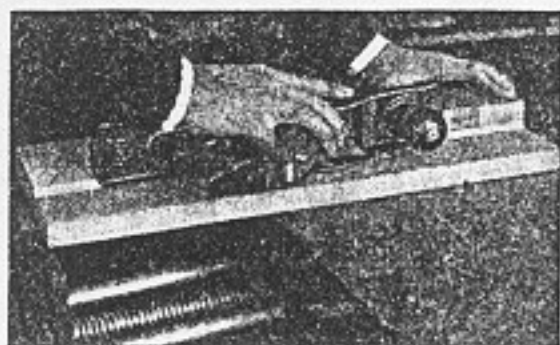


Fig. 107. Planing end wood using shooting board and jack plane.

QUESTIONS

1. When planing end grain, what is the important thing to guard against?
2. When planing end wood a plane or a plane is used.

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Fig. 108. Planing curved edge with a circular plane.

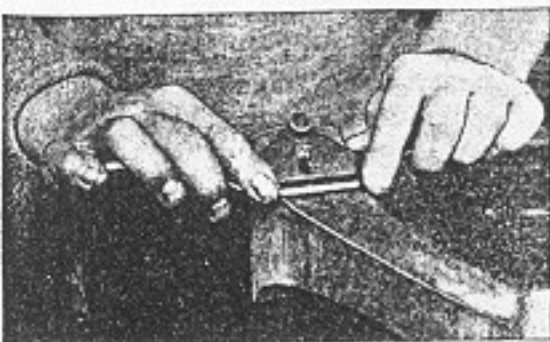


Fig. 109. Smoothing with a spokeshave.

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QUESTION

1. What is the advantage of a circular plane over a spokeshave on curves of larger diameter?

42. Smoothing Flat Surfaces with a Cabinet Scraper. 1. A cabinet scraper somewhat resembles a spokeshave in appearance in that it is an iron casting with two handles, in which a single blade is held. These two tools are often confused by beginners.

2. The cabinet scraper is used only on flat surfaces after these have

4. Another very good way of planing the end of a narrow board is to use a planing device called a "shooting board," Figure 106. The board to be planed is held against the cross-piece of the shooting board, and it is planed with a jack plane or a fore plane, as shown in Figure 107.

been planed. It is indispensable on cross-grained woods, because it will produce a smooth cut even against the grain (Fig. 110). A scraper does not work satisfactorily on soft woods.



Fig. 110. Smoothing a flat surface with a cabinet scraper.

3. To use the scraper, a sharp blade is inserted (Sharpening Operation 4) from below, between the casting and the clamp, so that the bevel is toward the adjusting screw in the center.

4. This screw is turned all the way back, the scraper and blade are placed on a flat surface, and the two clamp screws are tightened.

5. The adjusting screw is turned to the right until it touches the blade, a trial cut is made and, if necessary, the adjusting screw is turned a little more until a fine shaving is produced.

43. Smoothing with a Hand Scraper. A hand scraper is a rectangular piece of steel with square edges. It may be used on both flat and curved surfaces. It is held with both hands and cuts either when pushed or pulled. It produces a finer shaving than the cabinet scraper, especially when pulled, and is therefore often used after the cabinet scraper to produce a smoother surface (Fig. 111. See Sharpening Operation 5).

Molding scrapers are hand scrapers with curved edges. For planing a rabbet see Grooved Joints, Article 67. For planing a dado see Grooved Joints, Article 69. For planing a groove see Grooved Joints, Article 71.

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Fig. 111. Smoothing a flat surface with a hand scraper.

QUESTIONS

1. What is the difference between the blade of a cabinet scraper and that of a hand scraper?
2. Which of these scrapers can take the biggest shaving?
3. Should a scraper be used on soft wood?
4. Should a scraper be used before or after planing? before or after sandpapering?

Chapter V

PLANING JOBS

45. Squaring Narrow Boards to Dimensions.
46. Squaring Wider Boards to Dimensions.
47. Squaring Legs for Tables, Chairs,

and Cabinets.
48. Tapering Legs for Tables, Chairs,
and Cabinets.

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Chapter V

PLANING JOBS

Squaring. To square a board means to measure, saw, and plane it until the sides, edges, and ends are square to each other and of the exact dimensions required. This is the most fundamental job in all woodwork, and must be mastered before even the simplest project can be made.



Fig. 114. Testing flatness of a surface with a try-square.



Fig. 115. Testing edge for squareness with a try-square, holding the handle of the square firmly against the working face.

45. Squaring Narrow Boards to Dimensions. While this may be done in various ways, the following order of tool operations is recommended for boards less than 8 in. in width. The worker should read the directions from steps 1 to 12 and test his knowledge by answering the questions at the end of step 12 before beginning the work.

1. One of the broad surfaces or sides is planed until it is true and flat in all directions (Planing Operation 35). It is tested with the try-

square along the grain, across the grain, and diagonally (Fig. 114). The surface is called the *working face*.

2. One of the edges is planed until it is straight and square to the *working face*. The straightness of the board is tested with the edge of the plane (Fig. 97), and the squareness with the try-square, holding the handle of the square firmly against the working face (Fig. 115. See Planing Operation 36). This edge is called the *working edge*.

3. The working face and the working edge are marked with a pencil, because all future measurements are laid out from these. They must therefore be plainly marked (1, Fig. 117).

4. The width that the board is to have from the working edge is laid off. This is done either by gauging with a marking gauge (Laying-Out Operation 13) or by measuring at two points near the ends and drawing a straight line through these points (2, Fig. 117).

5. To prevent splitting the wood, a corner is chiseled or planed off outside the line marked, and the end is planed square to both working edge and the working face (Fig. 116. See Chiseling Operation 52). A corner must not be chiseled off on the working edge. The planing is done from the working edge toward the chiseled-off corner, and



Fig. 116. Chiseling off a corner to prevent splitting when planing end grain.

the plane must not be dragged back over the end, as this may split the corner on the working edge (Planing Operation 39).

Squareness is tested with the try-square both from the working face and the working edge, holding the handle of the square firmly against the face and edge (Figs. 118 and 119).

6. From the squared end, the length the board is to have is now measured. A line is squared all around the board at this point (Laying-Out Operation 12, and 3, Fig. 117).

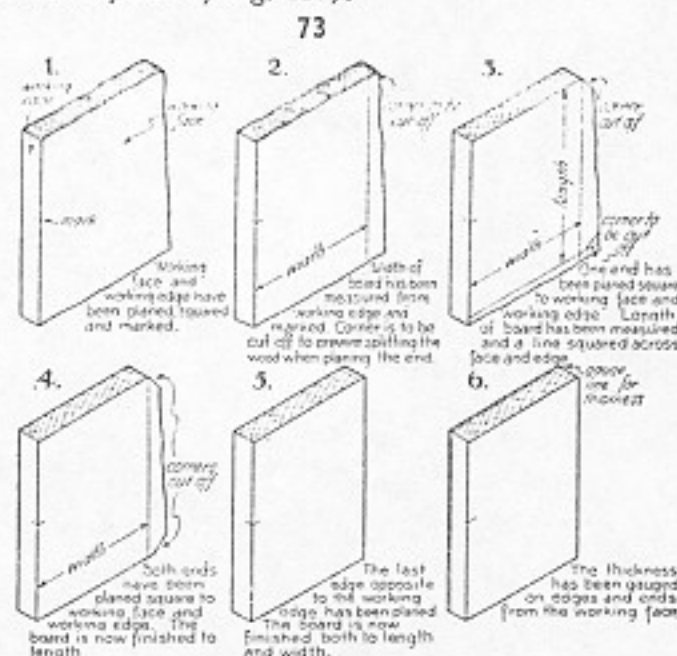


Fig. 117. Steps in squaring narrow boards to dimensions.



Fig. 118. Testing end for squareness from working edge.



Fig. 119. Testing end for squareness from working face.

7. The end is sawed off $1/16$ in. outside this line. While sawing, the board is clamped in a bench vise or it is held against a bench hook (Sawing Operations 28 and 29).

8. The other end is planed, repeating the process explained in step 5 (4, Fig. 117).

9. The edge opposite the working edge is planed to the line marked, and it is tested frequently for squareness as the planing progresses (5, Fig. 117).

10. If the board also is to be planed to thickness, a marking gauge is set to the required dimension and both edges and both ends are gauged from the working face (6, Fig. 117).

11. The last face opposite the working face is planed to the gauge lines.

12. When a narrow board is not wide enough to permit the cutting off of a corner (step 5), a piece of waste wood is placed behind it in the vise (Fig. 120). This prevents the wood from splitting when the ends are planed.

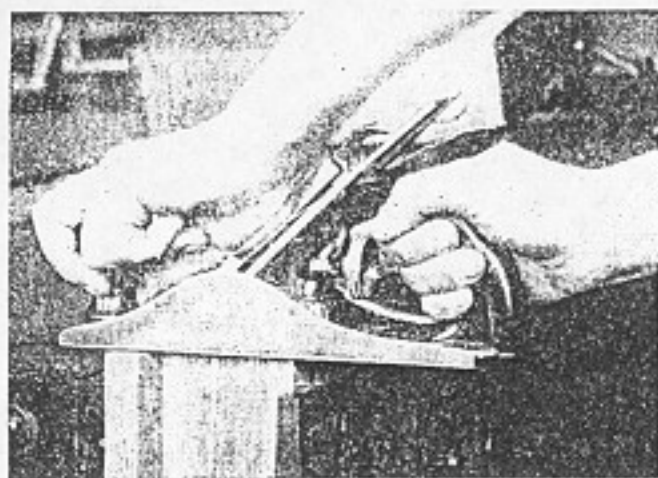


Fig. 120. Planing end of narrow board.

QUESTIONS

1. Why should the board be planed to length before it is planed to width?
2. Why is it wrong to cut off a corner on the working edge?
3. If a narrow board has been planed to width before it is planed to length, how can the ends be planed without splitting?

46. Squaring Wider Boards to Dimensions. When squaring wider boards, the order of tool operations recommended for smaller boards

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need not be followed, because the ends of the board are long enough to be planed part way from each edge.

1. A wide board is often made up of two or more narrower ones glued together (Gluing Operation 101). This is an advantage, because the tendency to warp and twist is diminished. Before beginning to plane the surfaces, any surplus glue is cleaned off with a chisel. Hardened glue dulls the plane iron.

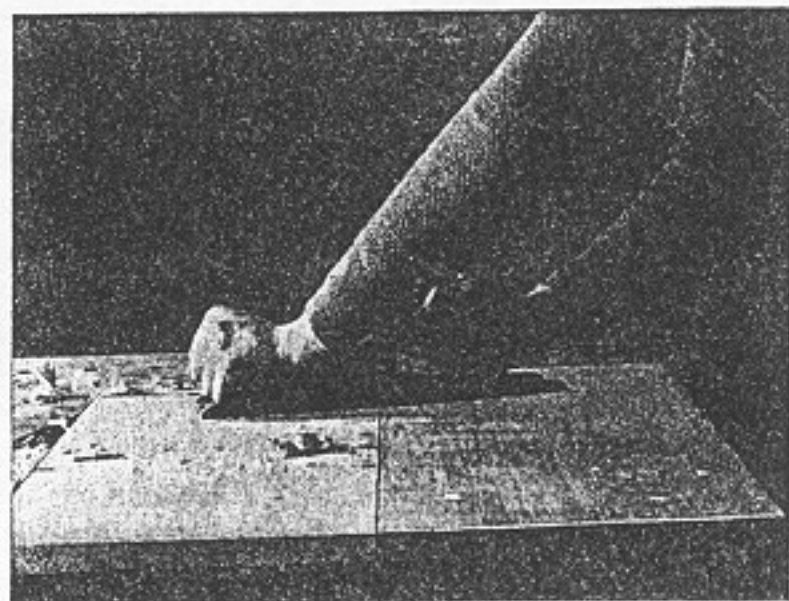


Fig. 121. Planing across the grain.

2. The best surface is selected and it is tested for flatness with a steel square. The high places are marked and are planed until they are reduced to the same level as the rest of the surface.

3. If the board is "in wind," it is planed diagonally from one high corner to the other (Planing Operation 35).

4. If it is glued up of two or more boards, or if the wood is hard or cross-grained, it is easier and quicker to true up the surface when planing across the grain. With a very sharp plane light cuts are taken, otherwise cross-planing tears up the grain. Cross-planing dulls the iron faster than planing with the grain. As soon as the iron begins to get dull, it must be changed or sharpened.

5. Planing is started at one end of the board and continued to the other (Fig. 121). The surface is tested for flatness with the framing square as the planing progresses.

6. When the surface is true, it is finished with a few light cuts with

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the grain, provided the grain runs straight. If the wood is cross-grained, it is smoothed with the cabinet scraper (Planing Operation 42).

7. The best edge is planed straight and is squared to the working face.

8. The length and width is laid out from the working edge, and any surplus is sawed off outside these lines.

9. As the ends are long enough to be planed from both edges toward the middle (Planing Operation 39), it makes no difference if the two ends or the remaining edge is planed first.

10. This thickness on both edges and ends is gauged, and the other side of the board is planed.

QUESTIONS

1. What are the advantages and disadvantages of cross-planing?
2. What precautions should be taken when planing across the grain?
3. How are boards "in wind" planed true?
4. How are cross-grained boards smoothed after planing?

47. Squaring Legs for Tables, Chairs, and Cabinets. When squaring legs for tables, chairs, stools, or cabinets, the problem is to get

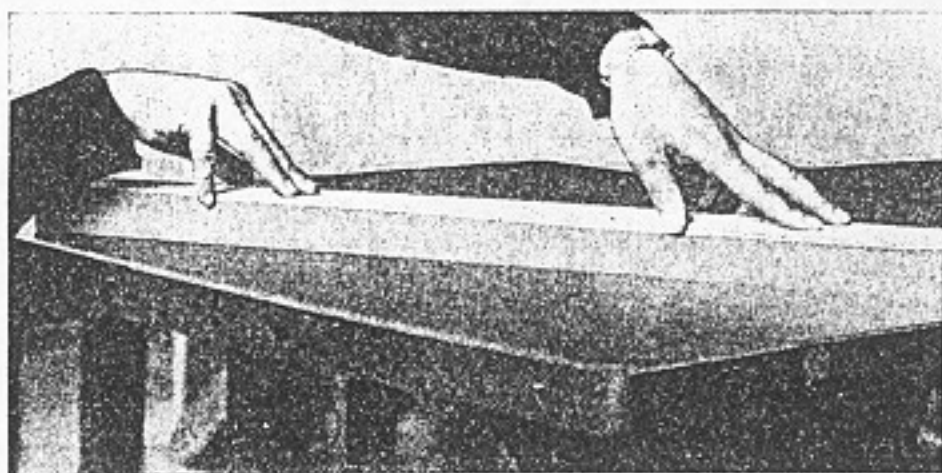


Fig. 122. Testing for "wind."

them all the same size. The following order of tool operations is recommended:

1. The legs are sawed out from the stock furnished, allowing at least $\frac{1}{4}$ in. on the width and thickness and $\frac{1}{2}$ in. on the length.
2. The best two adjoining sides on each leg are selected and marked.
3. One side is planed straight and true. It is tested on a perfectly flat surface, preferably of iron (Fig. 122). If it can be rocked, the high

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places are marked and planed off until the planed surface touches the iron surface at every point. It is very important to make this test before planing any of the other sides, because if the first side is not true, the others, planed square to it, will not be true either.

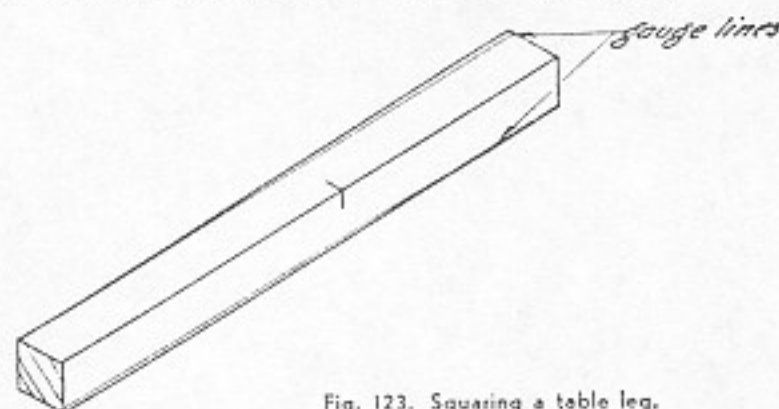


Fig. 123. Squaring a table leg.

4. The adjoining side selected is planed true and squared to the first one. These two sides are now marked because one is the working face and the other the working edge.

5. Steps 3 and 4 are repeated on the other legs.

6. A marking gauge is set to the required width, and the legs are

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gauged from the two squared sides. The width on all the legs is gauged with the same setting of the marking gauge (Fig. 123).

7. The two remaining sides on each leg are planed to the gauge lines, and squared to the first sides planed.

8. A line is squared around each leg about $\frac{1}{4}$ in. from one of its ends (Laying-Out Operation 12).

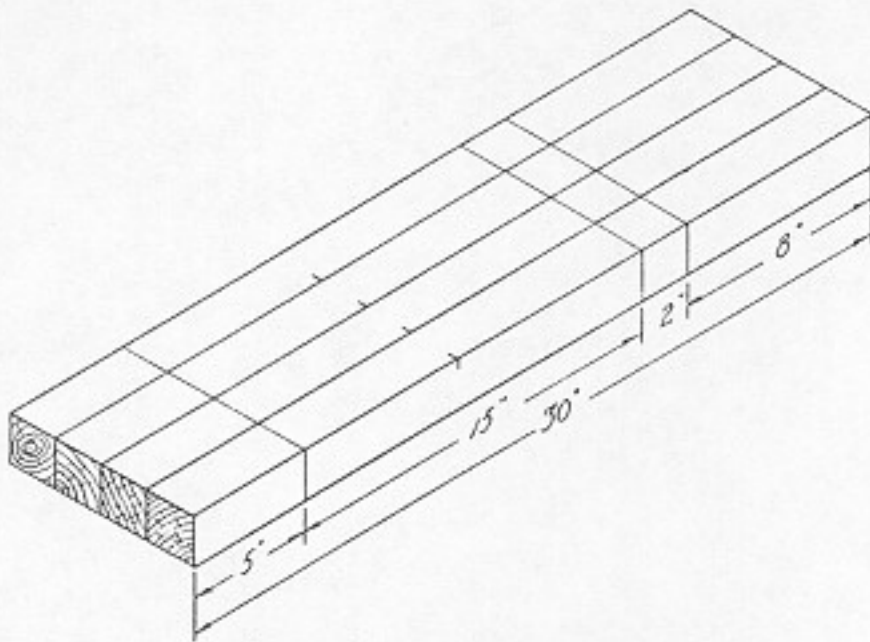


Fig. 124. Laying out duplicate parts.

9. The legs are placed side by side so that the lines just marked coincide. The length is measured, and a line is squared simultaneously across all the legs at this point (Laying-Out Operation 22 and Fig. 124).

10. Each leg is squared all the way around and sawed to length on the waste side of the lines squared (Sawing Operation 29).

QUESTIONS

1. Why is it important to test the first side planed on a flat surface?
2. What is the advantage of planing only two adjoining sides on each leg before completing the squaring process?
3. How is the width and thickness laid out?
4. How are the legs marked and cut to length?

48. Tapering Legs for Tables, Chairs, and Cabinets. The lower part of square legs often is tapered to make a piece of furniture look lighter and more graceful.

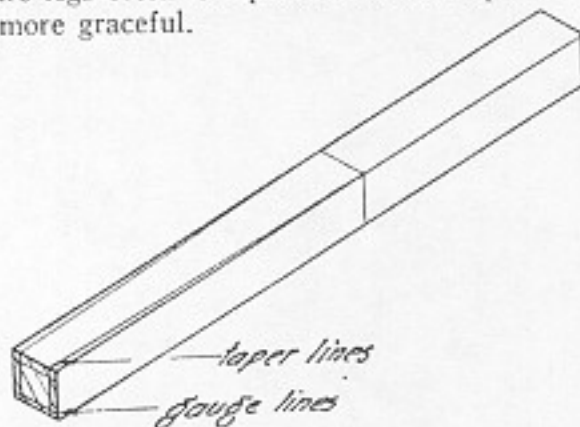


Fig. 125. Tapering square legs.

1. The legs are squared and cut to length (Art. 47).
2. The legs are placed side by side so that the ends are flush. The part to be tapered is measured, and a line is squared across all the legs at this point (Fig. 124).
3. This line is squared all around each leg (Laying-Out Operation 12).
4. The amount of taper is determined, for example, $\frac{1}{4}$ in. on each

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side. The marking gauge is set accordingly, and lines are gauged from each side on the end of each leg to be tapered (Fig. 125).

5. On two opposite sides straight lines are drawn from these points to where the taper begins.

6. These two sides are planed down to the taper lines.

7. The taper lines are laid out on the remaining two sides which are planed as before.

8. On hard and cross-grained woods the tapered sides are smoothed with a cabinet scraper (Planing Operation 42).

QUESTIONS

1. Why should the ends be squared before the taper is planed?
2. Why are the tapers not laid out on all four sides at the same time?

Chapter VI

CHISELING OPERATIONS

50. Chiseling Along the Grain, or Paring.

51. Chiseling Across the Grain.

52. Vertical Chiseling.

53. Cutting with a Gouge.

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Chapter VI

CHISELING OPERATIONS

The chisel is one of the oldest tools in the history of woodworking. It was, no doubt, developed from the primitive stone and iron wedges, but differs from these in that it has only one bevel.

Chisels for woodworking are made in several different shapes according to the work they are to perform. Those most commonly used are firmer chisels, paring chisels, and mortise chisels. A firmer chisel is an all-round tool that can be used both for light and heavy work (Fig. 128). A paring chisel has a thinner blade and should only be used for

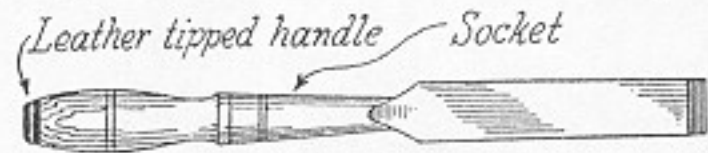


Fig. 128. Socket firmer chisel.

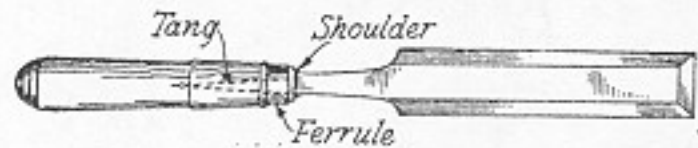


Fig. 129. Tang paring chisel.

light work (Fig. 129). The blade of a mortise chisel is unusually heavy just below the handle, because it is subjected to heavy pounding with the mallet and is also used as a lever to break loose the shavings it cuts (Fig. 130).



Fig. 130. Socket mortise chisel.

Chisels are made both with long and short blades. The latter are called "butt" chisels and are used principally for chiseling gains for hinges (see Metal Fastening, Art. 110). Chisel blades are made from $\frac{1}{8}$ to 2 in. in width. They are made either with square or beveled edges. According to the way in which they are constructed, chisels are called either "socket" or "tang" chisels. The upper part of a

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socket-chisel blade is shaped like a hollow cone into which the handle fits. The upper end of a tang-chisel blade is forged into a tapering point which is driven into the handle. A brass ring called a "ferrule,"

which is fitted around the lower end of the handle, prevents this from splitting. Chisel handles used for heavy or medium work are usually leather tipped to prevent splitting under the blows of the mallet.

50. Chiseling Along the Grain, or Paring. 1. When making a heavy or roughing cut, the chisel is used with the beveled side down. The handle is



Fig. 131. Roughing cut.

grasped in the right hand with the thumb pointing toward the blade,

and the cutting is guided by holding the blade firmly with the left hand, knuckles up (Fig. 131). The right hand forces the chisel into the wood while the left hand regulates the depth and the length of the cut. Chiseling always should be done *with* the grain. When chiseling against the grain, the cut cannot be controlled, because the chisel will follow the direction of the wood fibers. One shaving after another is removed until the line marking the depth of the cut has almost been reached.

2. The chisel now is reversed so that its beveled side is up. The handle is held in the right hand and the flat side of the chisel is held firmly against the wood. The chisel should be very sharp and only fine shavings should be cut (Fig. 132). If the edge is held diagonally to the direction of the cut, the chisel will do its work more easily and with less danger of "digging in." When chiseling cross-grained



Fig. 132. Smoothing cut.

wood, it is often necessary to change the direction of the cut several times.

3. A stopped chamfer is made by paring with a chisel. It is formed like a plain chamfer by flattening the sharp corner between two surfaces to right angles to each other. Most chamfers are made at 45 deg. (Planing Operation 38). An equal width is therefore marked on both

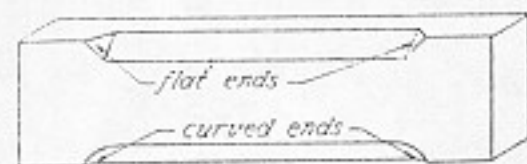


Fig. 133. Stopped chamfers.

4. The ends of a stopped chamfer may be either flat or curved (Fig. 133). In either case, chiseling is begun on the ends, but it must not be done quite down to the lines. If the ends are flat, the chisel is held with the bevel up. If they are curved, the chisel is held with the bevel down, as shown in Figure 134.



Fig. 134. Chiseling end of stopped chamfer.



Fig. 135. Finishing a chamfer.

vertical chiseling (Fig. 143). The curve is finished by paring with the beveled side up (Fig. 137).

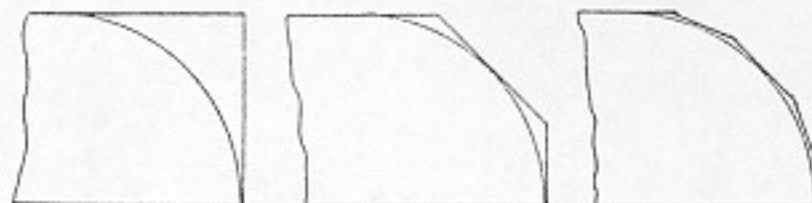


Fig. 136. Steps in chiseling a convex curve.

7. A concave curve is chiseled as follows: The beveled side of the chisel is held down, and chiseling is done from both ends of the curve toward the middle. As it is difficult to control the depth of the cut, great care must be used and only light cuts taken (Fig. 138).



Fig. 137. Finishing a convex curve.

QUESTIONS

1. What is the advantage of a socket chisel over a tang chisel?
2. What is the purpose of the ferrule?
3. Cutting fine shavings along the grain with a chisel is called
4. Why is the chisel sometimes held obliquely to the direction of the cut?
5. How is a convex curve chiseled?

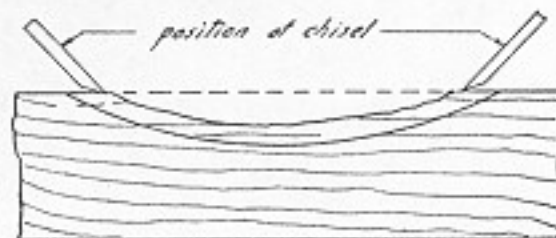


Fig. 138. Chiseling a concave curve.

51. Chiseling Across the Grain. 1. When making a dado joint (Grooved Joints, Art. 69), a middle-lap joint (Lap Joints, Art. 78), or a cross-lap joint (Lap Joints, Art. 80), the wood between the saw cuts is removed with a chisel.



Fig. 139. Chiseling across the grain, roughing cut.

2. With the bevel of the chisel held down, a cut is taken halfway across from both edges. On light work, blows of sufficient force are struck on the end of the chisel handle with the palm of the right hand. On heavier work a mallet is used (Fig. 139). The chisel should be guided so that the cut is also down to the gauge lines on the edges, but somewhat higher in the center.

3. The cut is finished by chiseling with the flat side of the chisel down. The



Fig. 140. Chiseling across the grain, finishing cut.

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QUESTIONS

1. A cross-lap joint is chiseled from both edges to prevent
2. When chiseling in maple, the should be used for striking blows on the chisel handle.
3. Why should a hammer never be used for striking blows on a chisel handle?

52. Vertical Chiseling. By vertical chiseling is understood cutting at right angles to the surface of the wood, usually across the fibers. Typical examples of vertical chiseling are a stopped dado, a gain for a hinge, and a mortise.

1. Most vertical chiseling consists in making first a perpendicular cut and then a slanting cut joining the first. By these two cuts a triangular groove is formed (Fig. 141). *The bevel of the chisel is always held toward the waste side of the cut.*



Fig. 141. Vertical chiseling.

2. The board is clamped securely to the bench top, and a light, perpendicular cut is made on the line, tapping the handle of the chisel lightly with a mallet. Too heavy a blow will force the chisel beyond the line and round the edge of the cut. Then a slanting cut is made on the waste side of the line so that a V cut is formed.

3. The procedure in step 2 is continued with alternate vertical and slanting cuts until the proper depth has been reached, gradually increasing the weight of the blows of the mallet. The wood is removed between the cuts by chiseling across the grain (Art. 51; see also Grooved Joints, Art. 70 and Fig. 184).

4. If a cut is to extend through the wood, it is laid out accurately on both sides, and half the depth is chiseled from each side. The edges are finished with light cuts, using hand pressure only.

5. When vertical chiseling is done near the end of the stock, as for example when rounding a corner, thin shavings can be removed without the aid of the mallet. The handle of the chisel is grasped with the right hand so that the thumb presses on top of the handle. The blade is guided with the thumb of the left hand (Fig. 142). If greater pres-

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sure is needed or much material has to be removed, the work is clamped securely to the bench and the chisel is grasped with both hands (Fig. 143). Such chiseling should be done on a cutting board or on the bench hook, but never directly on the bench top. The corner is finished by paring (Fig. 137). The board is chiseled from the edge toward the end.

6. A mortise simply means a hole, generally of a rectangular shape. When chiseling a mortise for a tenon or for a lock, either of the following two methods may be used:

7. The first method consists of boring a series of holes close together about 1/16 in. less in diameter than the width of the mortise. This leaves a number of small triangular projections along the sides, which are removed with a chisel having a rather wide and short blade. The

pressure of the hand should only be used for the finishing cuts, guiding the blade of the chisel with the thumb and first finger of the left hand (Fig. 140). On wider cuts, as on lap joints, a few extra saw cuts in the middle are very helpful as a depth gauge for the chisel (Fig. 199).



Fig. 142. Vertical chiseling on end wood. One hand guiding the blade.



Fig. 143. Vertical chiseling on end wood.

rounded ends of the mortise are made flat and square with the sides

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with a chisel a little narrower than the width of the mortise (Figs. 241 and 242).

8. The second method of making a mortise is by chiseling only. In this case a mortise chisel, Figure 130, of the same width as the mortise is used. This is driven into the wood with a mallet. It is important that the work is clamped on top of the bench and not in the vise on account of the heavy blows of the mallet. The chisel should be held perpendicular to the surface and the cut begun in the center of the mortise. Further directions are given in Article 92, steps 9 to 13, with accompanying illustrations, Figures 241 to 244.

QUESTIONS

1. How is a V cut made with a chisel?
2. What is the effect of a heavy blow with the mallet when beginning the cut?
3. How is a hole chiseled through a board?
4. What side of the chisel is always held toward the waste side?
5. What is a mortise and how is it made?
6. Why should the work be clamped on top of the bench when driving on the chisel with a mallet?

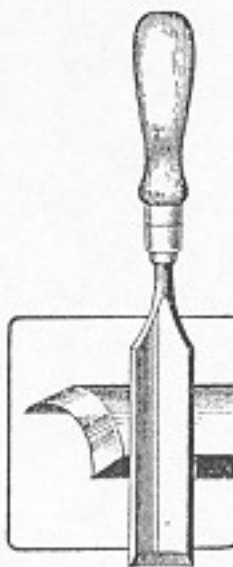


Fig. 144. Outside- and inside-bevel gouges.

53. Cutting with a Gouge. A gouge is simply a chisel whose blade has been bent lengthwise. Gouges for ordinary work are of two kinds, those having the bevel on the inside, called "inside-bevel gouges," and those having the bevel on the outside, called "outside-bevel gouges." According to the amount of curvature given the blade, gouges are classified as flat-sweep, medium-sweep, and regular-sweep gouges (Fig. 144). Gouges, like chisels, are made in widths from 1/8 to 2 in. They are either of the socket or the tang type.

1. Gouges are used for making concave cuts on moldings, edges, or broader surfaces, as trays or chair seats. They are manipulated in the same way as chisels, and are used for cutting along the grain, across the grain, and perpendicular to the surface.

2. An outside-bevel gouge works in the same way as a chisel with the bevel down. If it is moved slightly from side to side as it is pushed forward, it will be found to cut better. Roughing cuts should be taken with this gouge (Fig. 145).



Fig. 145. Roughing cut with outside-bevel gouge.

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3. When gouging a broader recess as on a tray, the cut is taken across the grain, because the depth of the cut is better controlled in this way, and the danger of digging in is minimized. Chiseling is begun at the edges of the cut and worked toward the center.

4. An inside-bevel gouge is used in the same way as a chisel with the bevel up. Its flat side must be kept in contact with the wood at all times, and only light cuts should be taken.

5. When cutting a hollow on long edges, a bent-shank gouge is used (Fig. 146). This type of inside-bevel gouge is bent so that the handle is clear of the wood surface when the gouge is in use (Fig. 147).

QUESTIONS

1. The two most common types of gouges are
2. What is the advantage of the bent-shank gouge?
3. The curvature of the gouge is called the



Fig. 146. Bent-shank gouge.



Fig. 147. Cutting hollow on edge with bent-shank gouge.

Chapter VII

BORING OPERATIONS

55. Boring Holes $\frac{1}{4}$ in. or More in Diameter.
56. Boring with an Auger Bit.
57. Boring with a Forstner Bit.
58. Boring with an Expansive Bit.
59. Boring Holes to a Given Depth.
60. Boring Holes Less than $\frac{1}{4}$ in. in Diameter.
61. Boring with Square-Shank Twist and Gimlet Bits.
62. Boring with Round-Shank Twist Drills.
63. Boring with Automatic Drills.
64. Boring with a Bradawl.
65. Reaming Holes with a Countersink

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Chapter VII

BORING OPERATIONS

55. Boring Holes $\frac{1}{4}$ In. or More in Diameter. The most common tools used for boring holes more than $\frac{1}{4}$ in. in diameter are the auger

bit, the Forstner bit, and the expansive bit. These bits are held in another tool called the brace. The most important parts of the brace are the head, the handle, and the chuck. The chuck has two jaws

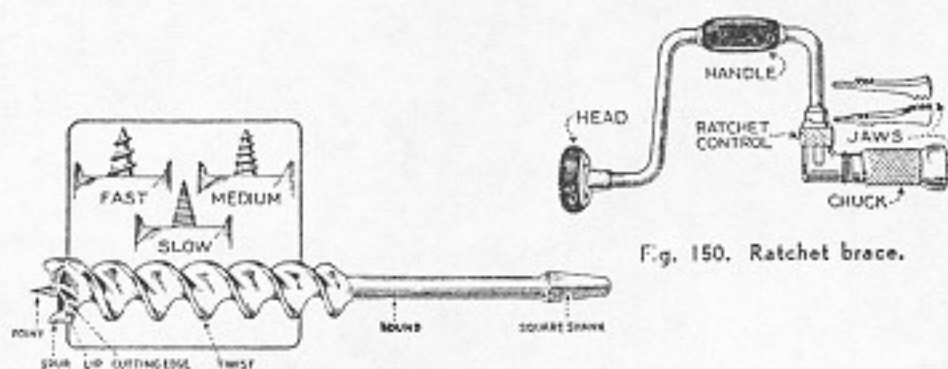


Fig. 150. Ratchet brace.

Fig. 151. Auger bit and auger-bit screws with different pitch.

which can only hold bits with a square shank. The diameter of the circle the handle of the brace makes in one revolution is called the *sweep*. The greater the sweep, the greater the power of the brace. The ratchet brace has a device which permits the handle to be reversed independently of the chuck. The ratchet brace can therefore be used in places where a complete revolution cannot be made (Fig. 150).

56. Boring with an Auger Bit. Auger bits are made in sizes up to 2 in. in diameter, but for ordinary work, bits from $\frac{1}{4}$ to 1 in. in diameter are used. The size of the bit is stamped on the shank in 16ths of an inch. A bit with the number 12 stamped on the shank, therefore, bores a $\frac{3}{4}$ -in. hole, because $12/16$ is equal to $\frac{3}{4}$. The cutting parts of the auger bit are the *screw*, which centers the bit and draws

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it into the wood, the spurs or nibs, which score the circle, and the *lips*, which cut the shavings that are lifted out of the hole by the twist of the bit (Fig. 151).

Auger bits are made with different pitched screws for fast, medium, and slow boring (Fig. 151). A screw with medium pitch is most serviceable for all-round work. When boring in pitchy woods or in end wood a fast or a medium screw should be used because the fine threads of a slow boring screw clog up and thereby prevent the bit from going into the wood. Short auger bits are called *dowel* bits.

1. When a hole is to be bored through a piece of wood, its center is marked and the wood is clamped vertically in the bench vise.

2. The screw of the bit is placed exactly on the center marked, the brace is held against the body so that the bit enters the wood at right angles to the surface, and then the brace is revolved until the screw

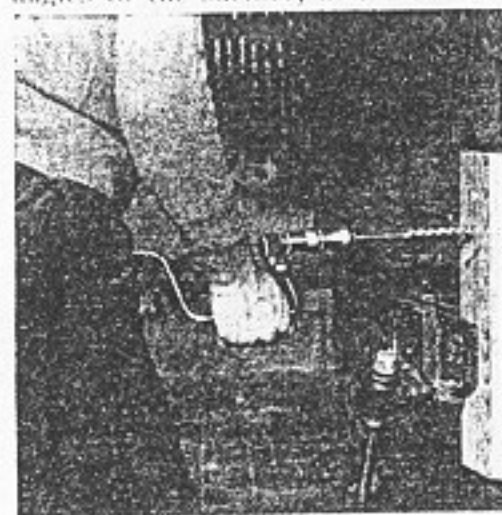


Fig. 152. Boring with an auger bit.

projects through the wood on the opposite side (Fig. 152).

3. The bit is withdrawn from the hole, the wood is reversed in the vise, and the boring is finished from the other side. If the boring were continued from the same side, the wood would split around the edge of the hole.

4. Holes may be bored through two or more boards clamped together without danger of splitting the wood of the interior surfaces.

QUESTIONS

1. What are short auger bits called?
2. What is understood by the "sweep" of a brace?
3. What is the advantage of a ratchet brace over a plain brace?
4. What are the principal parts of an auger bit, and what does each part do?
5. What is understood by the "pitch" of the screw?
6. Why is a hole bored from both sides?

57. Boring with a Forstner Bit. A Forstner bit has a rim which centers the bit and scores the circle, and two lips which cut the shav-

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ings. The numbers indicating its size in 16ths of an inch are stamped on the shank. Forstner bits are made in sizes up to 2 in. in diameter, but for ordinary work, bits from $\frac{3}{8}$ to 1 in. in diameter are used. As these bits have no screw, they are more difficult to center than the auger bits (Fig. 153).

1. A circle is marked with a pair of dividers equal to the size of the hole to be bored. This must be done to center the bit.

2. For through boring, a piece of waste wood is clamped behind the work to be bored to prevent splitting.

3. The advantages of Forstner bits over auger bits are that they will bore a hole close to an end on thin stock, which the screw of the auger bit would split; they will bore a larger hole where a smaller one has already been bored; they bore well in end wood, and they will bore straight through knots and cross-grained wood.

QUESTIONS

1. What are the principal differences in construction between an auger bit and a Forstner bit?
2. What advantages has a Forstner bit over an auger bit?

58. Boring with an Expansive Bit. An expansive bit resembles an auger bit in that it has a screw, spurs, and lips. It resembles a Forstner bit in that it has no twist. The expansive bit is furnished with two or three cutters or spurs, so that holes from $\frac{7}{8}$ to 4 in. in diameter can be bored (Fig. 154).

1. The spur is fastened to the bit by means of a screw passing through a small steel clamp.

2. Adjustment is made by moving the spur until the desired line of the scale engraved on it is opposite a line marked on the steel clamp. In the best types of expansive bits, the spur is moved sideways by means of a screw. This prevents the spur from slipping during the boring operation. Each division on the scale corresponds to $\frac{1}{16}$ in., but is actually only $\frac{1}{32}$ in.

3. The accuracy of the adjustment is tested by boring in a piece of waste wood and measuring the diameter of the hole produced.

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4. The expansive bit is used in the same manner as the auger bit. For through boring it is preferable to prevent splitting by clamping a piece of waste wood behind the one being bored rather than to bore from both sides. In the latter case the center is cut away before the wood at the circumference of the hole, and the bit is therefore difficult to control.

QUESTIONS

1. Why is it that the divisions on the scale of an expansive bit correspond to $\frac{1}{16}$ in. although they are only $\frac{1}{32}$ in. apart?
2. Which is the best way to bore a through hole with an expansive bit?

59. Boring Holes to a Given Depth. When a series of holes or even a single hole is to be bored to a certain depth, a gauge should be used. Two types of gauges, which may be clamped to bits up to 1 in.

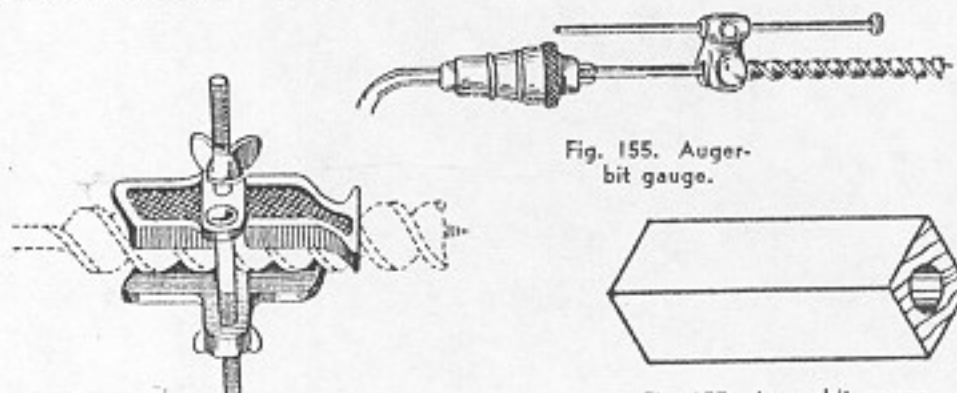


Fig. 155. Auger-bit gauge.

Fig. 156. Auger-bit gauge.

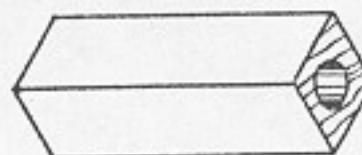


Fig. 157. Auger-bit gauge made of wood.

in diameter, are shown in Figures 155 and 156. In the absence of either of these, a homemade gauge can very easily be made from a small block of soft wood (Fig. 157).

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Fig. 158. Boring hole, using gauge for depth and try-square for direction.

1. The auger bit to be used is run through the wood, the depth of the hole to be bored is measured, and the block is cut so that when it butts up against the chuck of the brace, the bit projects this distance.

2. For accurate boring, the wood is clamped horizontally in the vise, and a try-square is placed at right angles to the surface of the work. The knob of the brace is grasped with the left hand, and the forehead is held against it to guide the bit (Fig. 158).

3. Boring is stopped at frequent intervals in the beginning to see if the bit is entering the wood at the right angle. Any small deviation should be corrected before the bit enters too deeply. The angle of the boring should not be corrected after the bit has entered too far, as this will bend the bit.

4. To correct a hole bored at the wrong angle, a dowel is glued into it. When the glue is dry, the dowel is cut off flush with the surface and the hole is rebored.

5. A helper also may aid in accurate boring — especially if the wood is clamped vertically in the vise — by "sighting" the bit. A workman sighting a bit stands a few feet from the one boring, and judges the boring angle by eyesight only.

QUESTIONS

1. How can an auger-bit gauge be made of wood?
2. How can a try-square be used with an auger bit?
3. What can be done to repair the damage when a hole has been bored incorrectly?
4. What is meant by "sighting" a bit?

60. Boring Holes Less than $\frac{1}{4}$ in. in Diameter. Holes of smaller diameters are bored with tools that are quite different from those used for boring holes of larger diameters. The most common of these tools are the gimlet bit, the twist drill, the fluted drill point, and the bradawl. Small diameter holes are bored mainly for wood screws (Art. 108).

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61. Boring with Square-Shank Twist and Gimlet Bits. 1. Gimlet Bits are made in sizes from $\frac{4}{32}$ to $\frac{12}{32}$ in. The size is stamped on the square shank in 32nds of an inch. The number 6, for example, therefore, indicates $\frac{6}{32}$ or $\frac{3}{16}$ in. Their cutting edge is on the side and cannot be resharpened. Gimlet bits of good quality keep sharp for a long time and are fast-boring bits.

2. Twist Bits for ordinary work range in size from $\frac{1}{8}$ to $\frac{3}{8}$ in. by 32nds. The full fraction usually is stamped on the tang, but when only



Fig. 159. Twist bit.

one number is stamped, 32nds of an inch is understood. Twist bits are more pointed than twist drills and can only be used in wood (Fig. 159).

3. Twist Drills look like twist bits, but have a blunter point (Fig. 160). They can be used for both wood and metal and are obtainable singly and in sets from $\frac{1}{32}$ to $\frac{3}{8}$ in. by 64ths. Larger size twist drills generally are not used in the woodworking shop. Twist drills usually are made with a straight, round shank, but some are made with a square shank. The latter type is called *bit stock drill* and can be used with the brace.



Fig. 160. Twist drill.



Fig. 161. Gimlet bit.

4. The brace must be held steady while boring because bits of small diameter break easily. A wooden block also may be used as a gauge on these bits (Art. 59). A small hole made with an awl (Fig. 164) will help to center the bits when many holes are to be bored.

QUESTIONS

1. What common boring tools are used for boring holes for screws?
2. How can a twist bit be distinguished from a twist drill?
3. What type of bits can be used with a hand drill?

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62. Boring with Round-Shank Twist Drills. 1. Round, straight-shank twist drills cannot be used with the ordinary brace, but must be held in a hand drill.

2. A hand drill is not properly a woodworker's tool, but it is very handy to have around the shop. It consists of an iron or steel frame which has a handle of wood or metal on its upper end. A short shaft with a chuck having three jaws is fastened to its lower end. The shaft with the chuck is revolved by means of a pinion and a gear wheel (Fig. 162).

3. The average hand drill does not hold drills over $\frac{1}{4}$ in. in diameter. This tool is better than the brace when fine holes are to be bored, because it can be held more steadily while boring.

QUESTIONS

1. How does a hand drill differ from a brace?
2. What is the difference between a bit-stock drill and a straight-shank drill?

63. Boring with Automatic Drills. Automatic drills are spiral-driven tools used for rapid boring of small holes (Fig. 163). A downward pressure on the handle revolves the bit. A spring inside the handle brings it back to its original position. Each drill is usually furnished with eight drill points from $\frac{1}{16}$ to $\frac{11}{16}$ in. in diameter by 64ths. These drill points are fluted and bore well

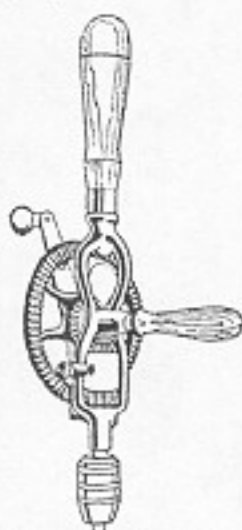


Fig. 162. Hand drill.

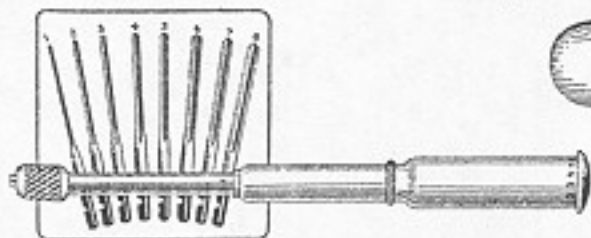


Fig. 163. Automatic drill and drill points.

in soft metals and wood. Their shank is shaped to fit the special chuck on the automatic drill. Ordinary straight-shank drills cannot be used.

64. Boring with a Bradawl. A bradawl looks more like a small screw driver than a boring tool (Fig. 164). It is used to bore holes for

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screws of small diameters. By twisting it back and forth, the fibers of the wood are forced apart, but no shavings are removed.

Boring is started with the cutting edge of the awl across the grain of the wood, otherwise it is likely to split thin wood, especially near the end.

65. Reaming Holes with a Countersink. The countersink has a cone-shaped cutter and a square shank, which can be held in a brace (Fig. 165). It is used to widen the upper part of holes bored for flat-head screws, because these screws always must be set flush or slightly below the surface of the wood. A

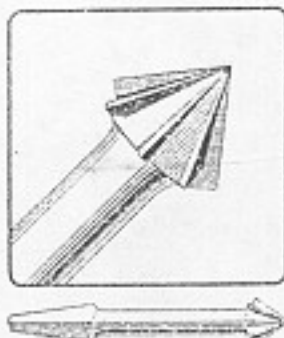


Fig. 165. Countersink.

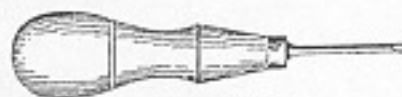


Fig. 164. Bradawl.

gauge may be obtained for countersinks, so that a series of holes may all be reamed out to the same depth.

Chapter VIII

GROOVED JOINTS

67. Making a Rabbet Joint Along the Grain.
68. Making a Rabbet Joint on End Wood.
69. Making a Dado Joint.
70. Making a Gain or Stopped-Dado Joint.
71. Making a Groove.
72. Making a Groove-and-Rabbet Joint.
73. Making a Dado-and-Rabbet Joint.
74. Making a Simple Drawer.

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Chapter VIII

GROOVED JOINTS

Grooved joints are made by cutting out a rectangular portion or recess, either with the grain or across the grain, on one member, into which the side or the end of another member is fitted.

In a *rabbet joint* the rectangular part is cut away either on the edge or the end of a board. This joint is used in furniture construction, in door and window construction, some types of box construction, in picture and mirror frames, and in many other types of woodwork.

67. Making a Rabbet Joint Along the Grain. 1. A special plane called a rabbet and fillister plane is used for this job (Fig. 168). The plane iron is adjusted to cut a shaving of the proper thick-

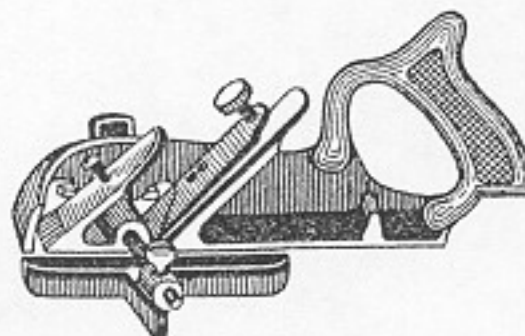


Fig. 168. Rabbet and fillister plane.

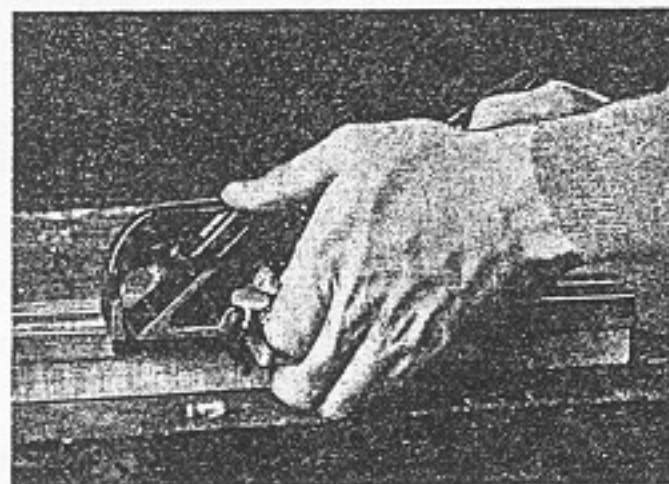


Fig. 169. Planing a rabbet.

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ness. It must be level with the bottom and in line with the side of the plane.

2. The plane has two adjustable gauges, one for depth and one for width. These are set according to the dimensions of the rabbet to be planed. The plane also has a spur which is fastened to the side of the plane so that it scores the wood in advance of the plane iron. This is used only when planing across the grain.

3. The board to be rabbeted is fastened in the workbench so that the depth gauge can move freely against its edge. The plane is held level and the width gauge is pressed against the edge of the board. Every stroke should be taken evenly and carefully and continued

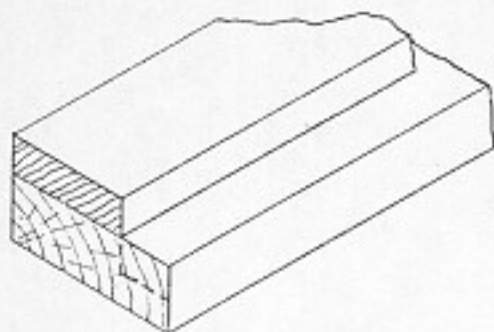


Fig. 170. Strip of wood clamped to board as a guide for the rabbet plane. Dotted lines indicate rabbet to be planed.

that when it touches the top of the strip the depth of the rabbet is reached.

QUESTIONS

1. How is the glass held in a picture frame?
2. How is a rabbet and fillister plane adjusted?
3. How can a rabbet be planed on a thin and narrow board?

68. Making a Rabbet Joint on End Wood. 1. A rabbet joint also can be planed across the end of a board with a rabbet plane, but if the board is narrow it is more convenient to saw and chisel such a joint. To make a rabbet joint with saw and chisel, the procedure is as follows:

2. A marking gauge is set equal to the thickness of the piece to be fitted into the rabbet. This distance is the width of the rabbet and

is gauged from the end of the board across its side and part way over the edges. The depth that the rabbet is to have is first determined, and then another line is gauged across the end of the board and down its sides until it meets the depth line (Fig. 171).

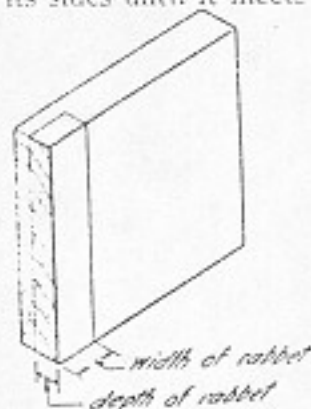


Fig. 171. Layout of rabbet on end wood.

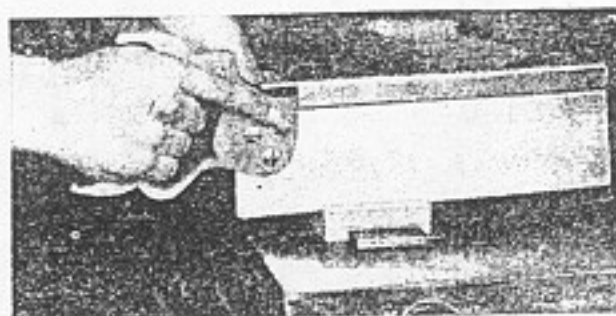


Fig. 172. Sawing with a backsaw on waste side of the line.

3. The board is sawed with a backsaw on the waste side of the width line (Fig. 172). A straight, even saw cut is obtained when the saw is started in a small, triangular groove cut with a chisel.

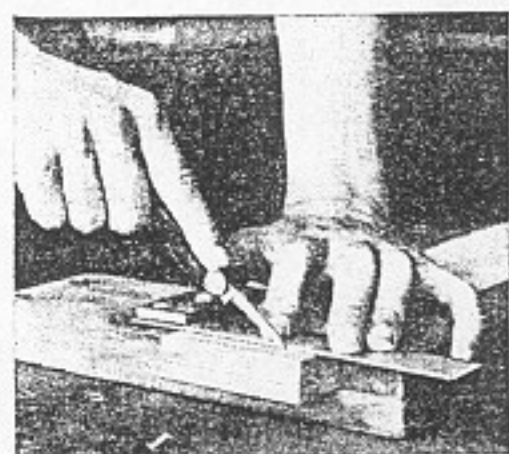


Fig. 173. Scoring line with knife.

4. To cut the groove, the board is held in the bench hook, or it is clamped in the vise, a try-square is placed right on the line, and it is cut with a knife along its blade (Fig. 173). The board is clamped on the bench, and a groove is cut on the waste side of the line with a chisel, holding the beveled side of the chisel up (Fig. 174). The groove can also be made by chiseling obliquely against the knife cut. The bevel of the chisel is held down (Fig. 175).

5. Another way of getting a straight saw cut is to clamp a block of wood along the line. The block acts as a guide for the saw (Fig. 176).

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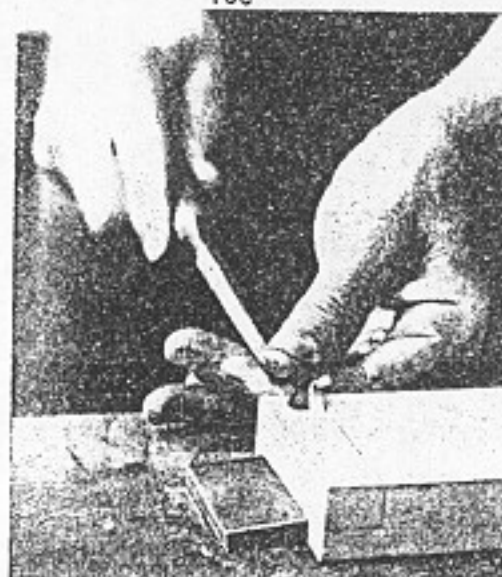


Fig. 174. Cutting triangular groove with chisel.

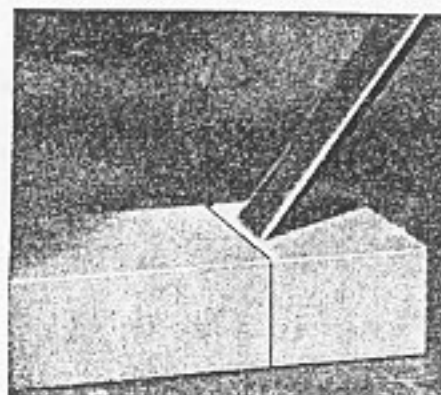


Fig. 175. Cutting triangular groove with bevel of chisel down.

6. The rabbet is now cut to depth with a chisel. The bevel of the chisel is held down and it is driven into the end wood with light blows of a mallet. Cutting is begun well above the depth line (Fig. 177). It is finished by chiseling across the grain, holding the chisel bevel side up (Fig. 178; also Fig. 140). A router plane also may be used if one side of it is held firmly against the face of the wood (Fig. 185).

7. This type of rabbet joint (Fig. 179) is nailed, or glued and nailed (Art. 106, step 12).

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QUESTIONS

1. How is the width of the rabbet obtained and laid out?
2. How is a triangular groove cut for guiding the backsaw?
3. How is the waste wood removed with a chisel?
4. How is this type of rabbet joint held together? Why is glue alone not sufficient?

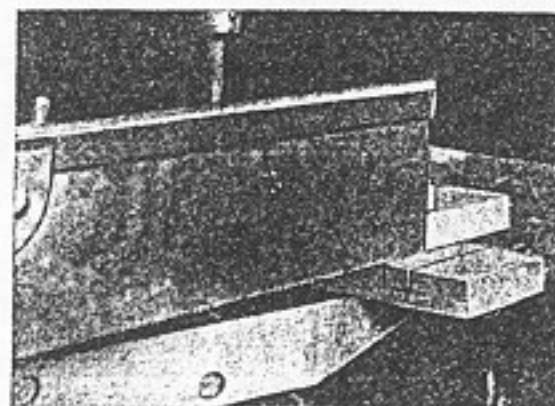


Fig. 176. Block hand-screwed to piece guiding backsaw.



Fig. 177. Cutting end wood with chisel, bevel down.

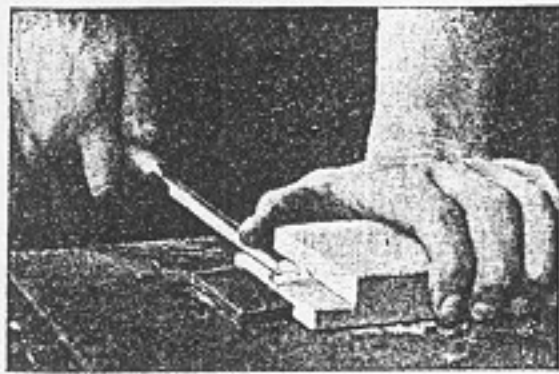


Fig. 178. Finishing rabbet with chisel, beveled side up.

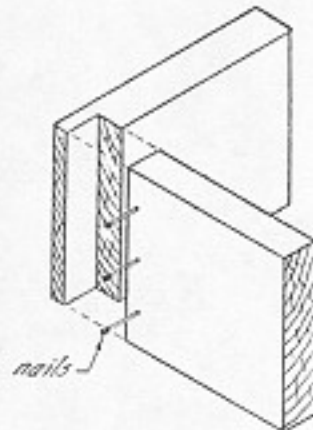


Fig. 179. Finished joint. Rabbet on end wood.

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69. Making a Dado Joint. A dado is a recess cut across a board from one edge to the other. A dado therefore has two vertical sides, while a rabbet, which is cut along the edge or end of a board, has only one. Dado joints are used on shelves, bookcases, cabinets, drawers, boxes, etc.

1. A piece of wood 4 in. or more in width and 8 in. or more in length is suitable for making a dado joint. This piece is squared to dimensions (Planing Job 45).

2. The length of the piece is measured, and a line is squared all around it in the center (Laying-Out Operation 12).

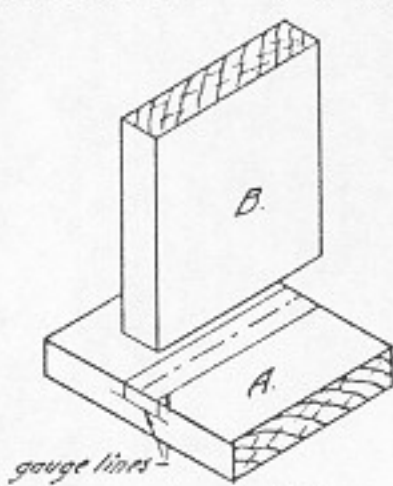


Fig. 180. Layout of dado joint.

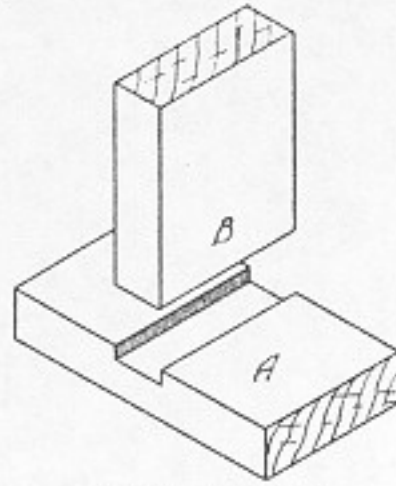


Fig. 181. Dado joint.

3. The piece is sawed in two on this line, holding it on a bench hook and using a backsaw (Sawing Operation 28).

4. The two sawed ends are now planed (Planing Operation 39).

5. A line is squared across one of the two boards, A, in the center. A dado always goes *across* the grain and never *along* the grain. Half the thickness of the other, B, is laid out to each side of this center line, and lines are squared across and down both sides with a knife or fine pencil point (Fig. 180). The accuracy of the measurements is tested by placing B perpendicularly on A. The depth of the dado is gauged, which is usually less than half the thickness of the stock.

6. The board is sawed on the waste side of the lines as explained in Article 68, steps 3 to 5.

7. The wood between the saw cuts is removed by chiseling across the grain, bevel down. Chiseling is done from both edges toward the middle to avoid splitting the wood (Chiseling Operation 51). The dado is finished with a router plane, working from both edges toward the middle (Fig. 185). If several dados are cut at the same time they may all be planed to the same depth with the router plane.

8. The pieces are fit together (Fig. 181). If the dado is too narrow, it must not be made wider, but a little is planed off the sides of board B until it fits snugly. If the dado is too wide, the joint is spoiled; it looks bad and will not hold.

QUESTIONS

1. A dado is a groove cut a board.
2. What tools are necessary for laying out a dado joint?
3. How can the accuracy of the layout be tested?

4. What would happen if a dado were chiseled in one direction only?
5. How can a number of dados be made exactly the same depth?
6. What should be done if the dado is too narrow?

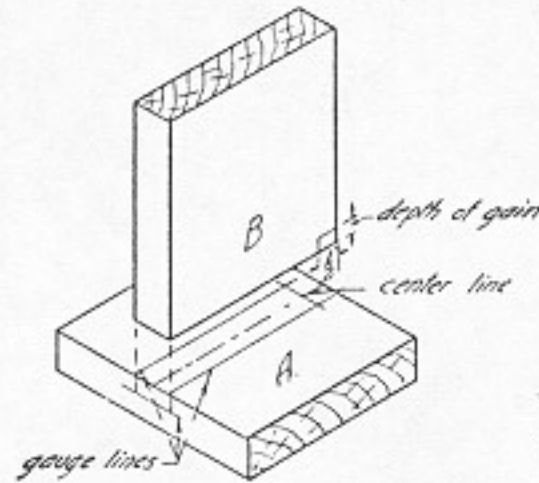


Fig. 182. Layout of gain joint.

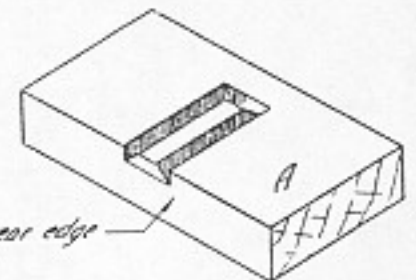


Fig. 184. Chiseling gain.

70. Making a Gain or Stopped-Dado Joint. A gain joint is a dado joint that does not extend all the way across a surface. It is therefore also called a stopped-dado joint. It is used for the same purposes as a dado joint, generally on better-class work, because it is neater in appearance.

1. In making this joint, a board is squared and sawed in two as when making a plain dado joint.

2. A center line is marked across A, and half the thickness of B is laid out to each side of it (Fig. 182). The gain should stop $\frac{1}{2}$ in. from the front edge, and this width gauged on both pieces with a marking gauge.

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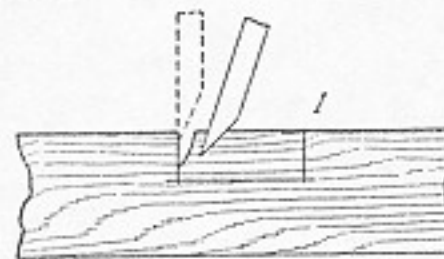


Fig. 183. Positions of chisel in chiseling gain joint.

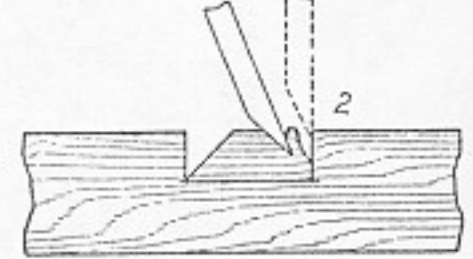


Fig. 185. Finishing gain with router plane.

3. The gain is chiseled out with a $\frac{3}{4}$ -in. chisel. The beveled side of the chisel is held on the waste side of the line, and light blows are struck with a mallet, being careful to follow the lines (Fig. 183).

4. First a small triangular groove is chiseled all around, and then it is gone over again, striking heavier blows (Fig. 184).

5. When the gain is deep enough, the board is chiseled across the grain with a $\frac{1}{2}$ -in. chisel and finished with a router plane (Fig. 185).

6. The notch marked in the front edge of piece B is sawed out on the waste side of the line. Then the pieces are fit together (Fig. 186).

QUESTIONS

1. How does a gain joint differ from a dado joint?
2. What kind of chisel is used, and how is it

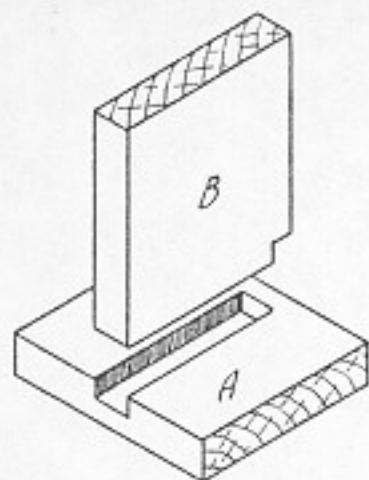


Fig. 186. Finished gain joint.

manipulated in chiseling a gain joint?

71. Making a Groove. A groove is a recess like a dado, but it is cut *along* the grain of the wood (Fig. 187). Grooves are used in drawer construction, panel work, and on flooring, sheathing, etc. Panels, drawer bottoms, and tongues of flooring and sheathing are not glued into grooves.

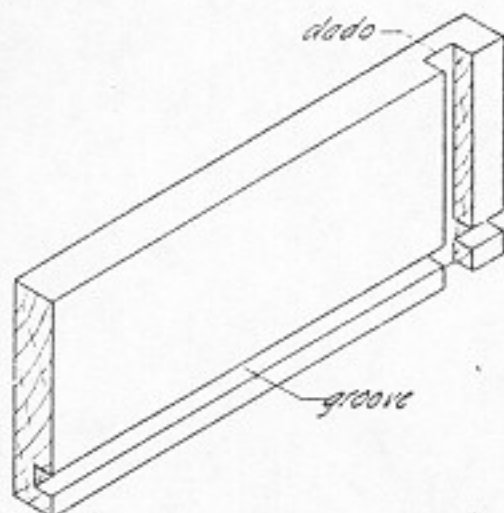


Fig. 187. Side of drawer showing groove and dado.

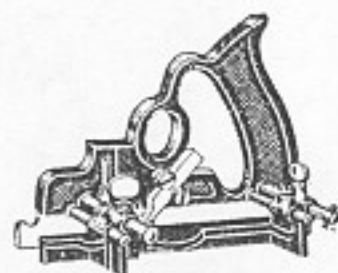


Fig. 188. Plow plane.

1. A groove can be planed with a special plane called a plow plane (Fig. 188). This plane resembles a rabbet plane and is fitted with depth and width gauges.

2. A plow plane with a double spur is called a dado plane and can be used both for dados and grooves.

3. A matching plane will plane a groove on the edge of a board and a corresponding tongue on the edge of another.

4. Grooves may also be worked out like dados with a chisel and router plane, but the process is more laborious and difficult, because wood splits easily along the grain, especially if the groove is near the edge of the board.

QUESTIONS

1. How does a groove differ from a dado?
2. In what types of construction are grooves used?
3. How does a matching plane differ from a plow plane?

72. Making a Groove-and-Rabbet Joint. This joint, which is also called a barefaced tongued joint, is used in cabinet construction when the sides are to be joined to front and back so that their surfaces are flush.

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1. The groove is made as explained in Article 71.
2. A rabbet is then planed on the edge of the piece to be joined to it (Fig. 189).
3. This joint should be glued and clamped.

QUESTIONS

1. What is understood by a barefaced tongued joint?
2. What is the principal use of a groove-and-rabbet joint?

73. Making a Dado-and-Rabbet Joint. This joint is a combination of two other grooved joints, the dado joint and the rabbet joint on end wood. It is stronger than either of these because it has a larger

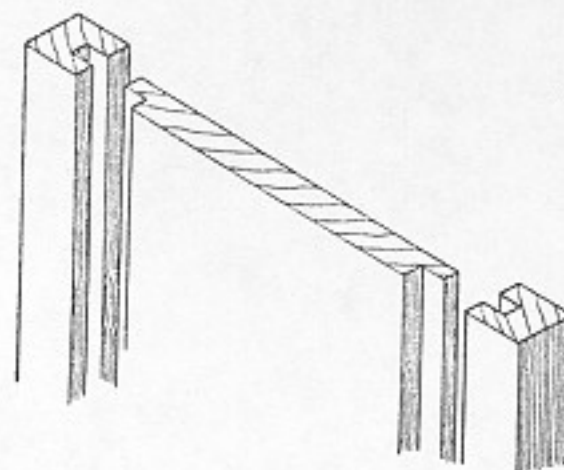


Fig. 189. Groove-and-rabbet joint.

gluing surface. It is used principally in boxes or boxlike constructions as chests and drawers (Fig. 190).

1. The pieces are squared to dimensions, and the thickness of the rabbeted member, A (Fig. 191), is gauged on the dado member, B, with a marking gauge.

2. The depth of the rabbet d is determined and gauged on both members. The depth usually is from one half to two thirds the thickness of piece A.

3. The width of the rabbet w is then gauged on both members. This usually is one half the thickness of piece B. This completes the layout of the joint.

4. The dado is made first as described in Article 69, and then the rabbet is made as described in Article 68. Before reaching the depth-gauge line on the rabbet, it is well to try how the pieces fit together. In this way the rabbet can be adjusted to fit the width of the dado.

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If the rabbet were cut first and the dado made too wide, no adjustment could be made.

QUESTIONS

1. What is the advantage of the dado-and-rabbet joint over the plain dado joint?
2. What is the advantage in working out the dado before the rabbet?

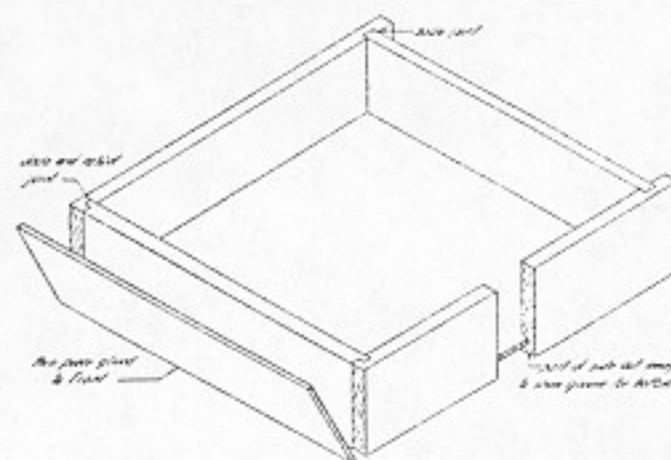


Fig. 190. Simple drawer construction, showing dado, groove, and dado-and-rabbet joints.

74. Making a Simple Drawer. In making a good, substantial drawer, only grooved joints need to be used.

1. The two sides, the back, and the front are planed to dimensions. The back and the sides usually are made of thinner stock than the front, which has to be stiff to withstand the pull on the drawer.

2. A plywood bottom is the easiest to make, because all that need be done is to cut it to size. It also is stronger than solid wood and does not shrink.

3. Grooves are plowed about $\frac{3}{8}$ in. from the lower inside edge on the sides and front piece for this bottom (Art. 71).

4. The sides are joined to the front with a dado-and-rabbet joint (Art. 73), and to the back with a dado joint (Art. 69 and Fig. 190).

5. The sides, front, and back are glued together, care being taken to get the corners square. The glued-up drawer is then placed on a flat surface so that it does not rock. After the front and sides are planed carefully, a piece of $\frac{1}{4}$ -in. stock is glued to the front of the box. When clamping, a piece of $\frac{7}{8}$ -in. stock of the same size is used to

distribute the pressure of the hand screws.

6. This $\frac{1}{4}$ -in. piece may be made of exactly the same width and length as the drawer opening, or it may be made to project on the top

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and sides of the drawer. Such a piece not only conceals the end wood of the sides, but it materially strengthens the joint.

7. The bottom is slid into place and fastened to the underside of the back with glue, nails, or screws. The bottom should not be glued into the grooves.

8. Instead of a dado-and-rabbet joint, the front and sides of a drawer also may be joined with a plain rabbet joint (Fig. 179) glued and nailed together. The best way of joining front and sides, however, is with a multiple dovetail joint. This construction is used on all high-class work; but, as the making of the dovetail joint is too difficult to come within the scope of this book a description of this joint has been omitted.

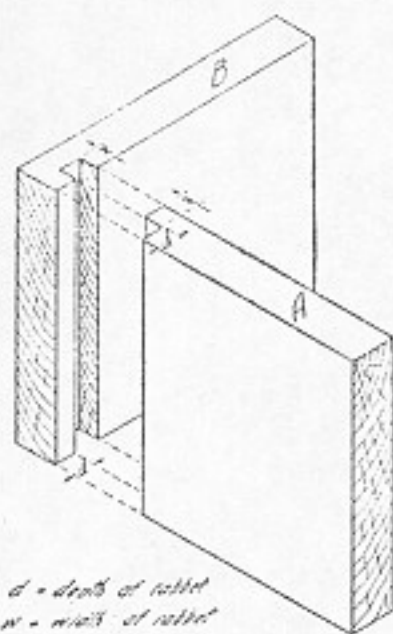


Fig. 191. Dado-and-rabbet joint.

QUESTIONS

1. How many types of grooved joints are used in this drawer?
2. Why is plywood better for a drawer bottom than solid wood?
3. Why should a drawer be placed on a flat surface when it is glued?

Chapter IX

LAP OR HALVING JOINTS

76. Making an End-Lap Joint.
77. Making an End-Lap Joint with Rabbet.
78. Making a Middle-Lap Joint.
79. Making a Dovetail-Lap Joint.
80. Making a Cross-Lap Joint.

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Chapter IX

LAP OR HALVING JOINTS

In lap or halving joints half the thickness of each member is cut away so that when they are joined together their upper and lower surfaces will be flush.

The lap joints most commonly used are the end-lap, the splice, the end-lap with rabbet, the middle-lap, the dovetail-lap, and the cross-lap joints. Lap or halving joints are used in cabinetmaking, carpentry, and patternmaking.

76. **Making an End-Lap Joint.** This joint may be used when four pieces are joined to make a frame for lattice work, for a screen, for a chair seat, or for any other purpose where a frame is needed. The carpenter also uses the end-lap joint in framing the timbers for the sill and plate of a house.

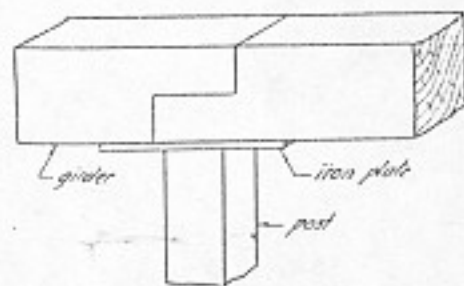


Fig. 194. Spliced joint on girder.

1. The pieces are cut to length, and are planed to width and thickness.
2. The face or upper side of each member is marked, and the width

of one is laid out from the end of the others. Lines are squared all around each member at these points.

3. The most important thing to remember about laying out any lap joint is to *gauge from the face of each piece*. The thickness of the pieces is measured, and the marking gauge is set to half of this distance. Each member is then gauged *from the face* around the sides and end. The lower half of the upper member and upper half of the lower member are cut away as shown in Figure 195. Even if the marking gauge is not set exactly, the pieces will be flush when the joint is com-

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pleted because the combined thicknesses of the two cuts equal the thickness of one member of the joint.

4. One member is placed on top of the other in the position they are to occupy when the joint is finished, and the measurements and layout are checked (Fig. 195).

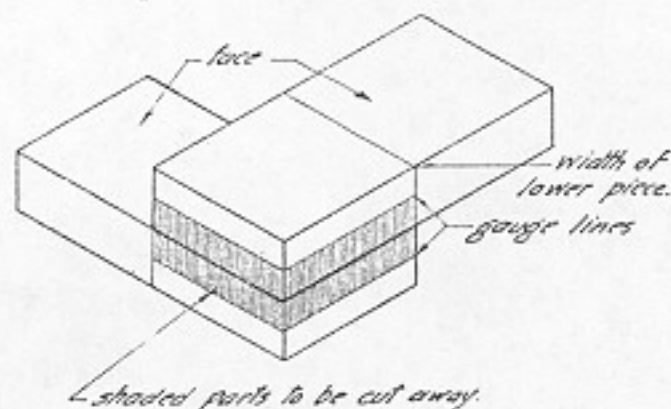


Fig. 195. Layout of end-lap joint.

5. The pieces are held in a bench hook or are clamped in a bench vise, and the shoulder cuts are made with a backsaw. As it is very important to make these shoulder cuts straight, perpendicular, and to



Fig. 196. Sawing cheek cut of end-lap joint.

the line, it is recommended either to cut a triangular groove with a chisel, in which to start the saw, or to clamp a block right on the line and let that serve as a guide for the saw. These shoulder cuts are made in the same way as on a dado (Figs. 172 to 176 inclusive).

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6. The cheek or side cuts (along the grain) may be cut either with a backsaw or a rip saw. The piece is clamped diagonally in the vise and is sawed on the waste side of the gauge line. In this way the gauge line, both on the end and one side, can be seen at the same time and followed (Fig. 196).

7. Sawing is continued until the line marking the shoulder cut has been reached. The piece is then reversed in the vise, and is clamped in a vertical position with the edge not sawed toward the worker. It is only necessary now to follow the gauge line on the side, because the first saw cut serves as a guide for the saw and insures greater accuracy.

8. The pieces are then fitted together. Their upper and lower surfaces should be flush and the side of one should fit tightly against the other. Any irregularity is removed with a chisel.

QUESTIONS

1. Why are lap joints also called halving joints?
2. In what part of a house frame is a lap joint used?

3. What is the important thing about gauging a lap joint?
4. How can the accuracy of the laying out be checked?
5. What can be done to make accurate shoulder cuts?
6. How are the cheek cuts made?

77. Making an End-Lap Joint with Rabbet. This joint is used on frames which are rabbeted to receive a panel, glass, or mirror.

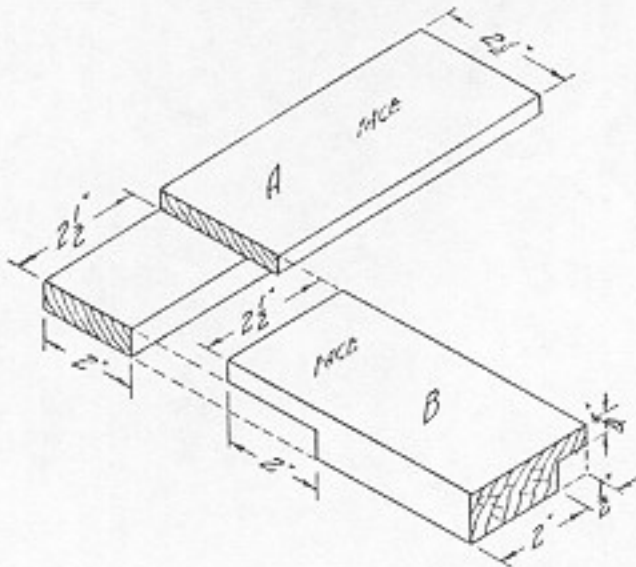


Fig. 197. Layout of end-lap joint with rabbet.

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1. The pieces are cut to dimensions and the rabbets are planed (Grooved Joints, Art. 67).

2. The joint is laid out as an ordinary end-lap joint, but the width of the rabbet is subtracted on piece B when the shoulder cuts are laid out (Fig. 197).

3. The marking gauge is set so that the side cuts come flush with the rabbet, and *both pieces are gauged from the face*. In this way the upper part of A and the lower part of B are cut away.

4. The shoulder and cheek cuts are made as explained in Article 76, steps 5 to 7. It now will be seen that the end from which the upper part has been cut away, A, has lost the width of the rabbet, while the other piece, B, still has its full width.

5. The joint is fitted together, and any irregularities are corrected with a chisel.

QUESTIONS

1. Where may such a joint be used?
2. Why is it necessary to subtract the width of the rabbet on one of the pieces when laying out this joint?

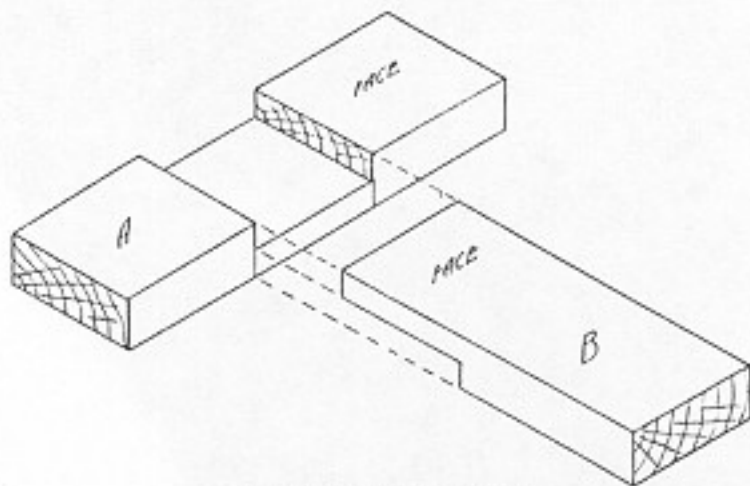


Fig. 198. Middle-lap joint.

78. Making a Middle-Lap Joint. In a middle-lap joint the end of one piece joins the other in the middle or at some point between the ends. This joint is used especially in house framing and timber construction.

1. A middle-lap joint is laid out like other halving joints. The width of A is marked on B and the width of B is marked on A. Usually the middle of A is found, a line squared across, and half the width of B

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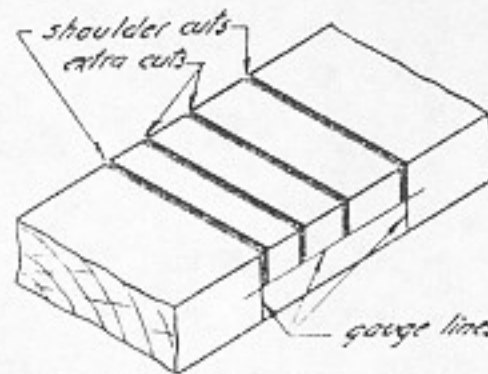


Fig. 199. Shoulder and center cuts for middle- or cross-lap joints.

waste side of the lines. A few extra saw cuts between the shoulder cuts will make the chiseling easier (Fig. 199).

5. The waste material is chiseled away. The chisel is held with the bevel down, and chiseling is begun well above the gauge lines. Chiseling is done from both sides to avoid splitting the wood at the edges (Fig. 200). The extra saw cuts will serve as a depth gauge for the chisel

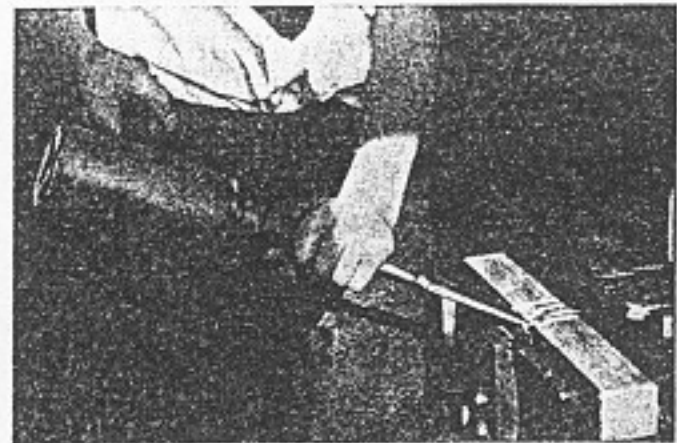


Fig. 200. Chiseling middle- or cross-lap joint, bevel down. Roughing cut.

and also will prevent too large pieces from being split off below the depth line.

6. The joints may be finished with a very sharp chisel. Chiseling is done across the grain with the flat side of the chisel in contact with the wood (Fig. 201). Only light cuts are taken. The joint also may be finished with a router plane.

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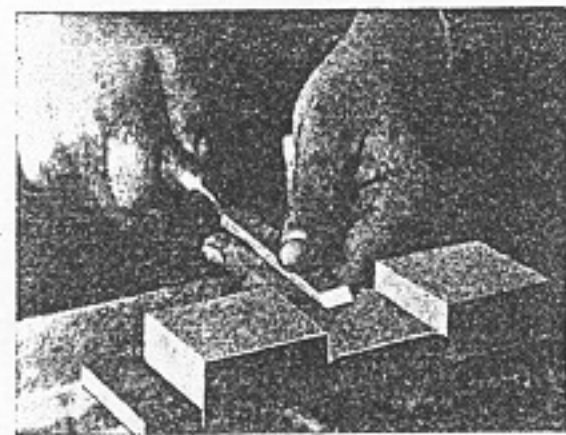


Fig. 201. Chiseling middle- or cross-lap joint, bevel up. Finishing cut.

7. If it is found that piece B (Fig. 198) is a little too wide for the recess cut in piece A, a little is planed off the edges of piece B. Nothing, however, should be chiseled off the shoulders of piece A. The joint must not be forced together.

QUESTIONS

1. What can be done to aid in chiseling a middle-lap joint accurately?
2. How is the joint chiseled to a uniform depth?
3. If the recess chiseled is too narrow, how should the joint be fitted?

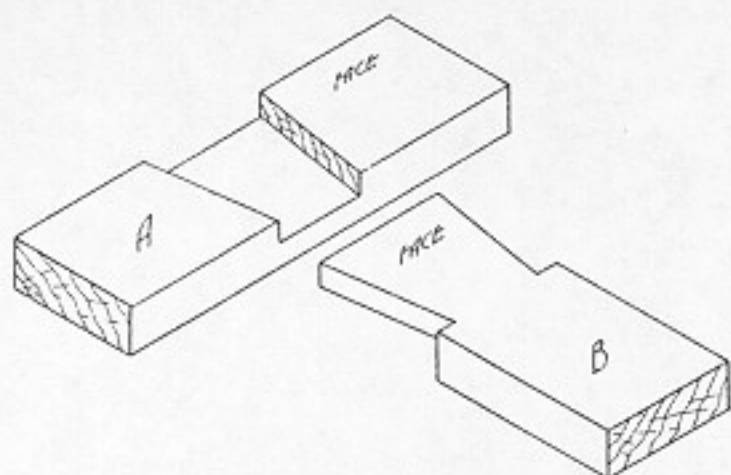


Fig. 202. Dovetail-lap joint.

79. Making a Dovetail-Lap Joint. This joint is a modified middle-lap joint (Fig. 202). It is made so that it cannot be pulled apart, and is therefore used where it is subject to pulling or tension strain. This

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joint is very common in furniture construction, as for example, on rails connecting two sides of a cabinet.

1. The joint is laid out as an ordinary middle-lap joint (Art. 78,

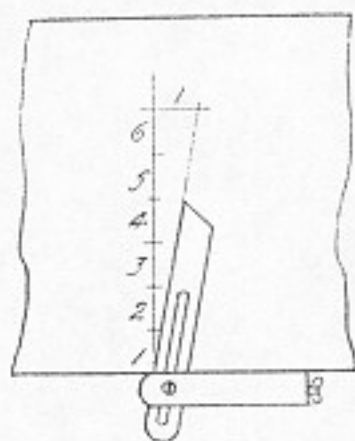


Fig. 203. Laying out angle of dovetail.

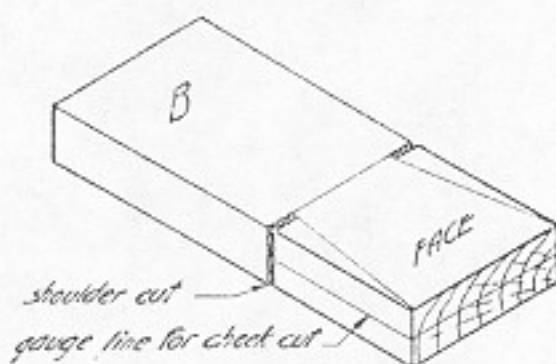


Fig. 204. Shoulder cut on dovetail-lap joint.

steps 1 and 2). The angle of the dovetail is then marked on the face side of piece B. This may be obtained as follows:

2. A line is squared across the surface of a board. Six equal spaces (for example, 1-in. spaces) are laid off with a rule or a pair of dividers

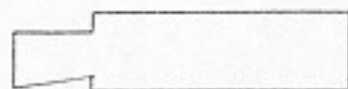


Fig. 205. Dovetail lap with one straight edge.

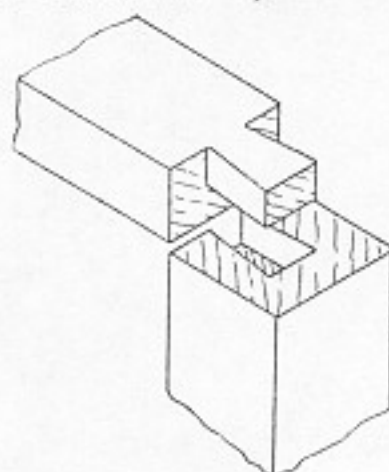


Fig. 206. Dovetail-lap joint.

on this line. At the end of the sixth space, a line is drawn parallel to the edge of the board. One space is laid out on this line, and from this point a line is drawn to the edge of the board where the first line begins. The sliding T bevel is set so that the stock is held firmly against the

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edge of the board and the blade coincides with the last line marked (Fig. 203).

3. Piece B is sawed as an ordinary end-lap joint (Art. 76, steps 5 to 7), but the shoulder cut is continued around both edges (Fig. 204). The cheek cut is finished, and then the angles of the dovetail are sawed.

4. Piece B is placed on top of piece A, and the outline of the dovetail is marked with a knife or a hard, sharp pencil point.

5. The board is sawed on the waste side of these lines, and the waste

wood is chiseled out as explained in Article 78, steps 5 and 6. The pieces now should make a good, tight fit.

6. A dovetail-lap joint sometimes is made with only one slanting side (Fig. 205). It is used in the same way as one with two slanting sides. Often it does not extend across the entire width of the wood (Fig. 206). In the latter case the entire recess for the dovetail must be worked out with a chisel.

QUESTIONS

1. How does a dovetail-lap joint differ from a middle-lap joint?
2. How is the correct angle of a dovetail obtained?

80. Making a Cross-Lap Joint. A cross-lap joint is used when two pieces cross each other so that their surfaces are flush. This joint is used more extensively than any other lap joint.

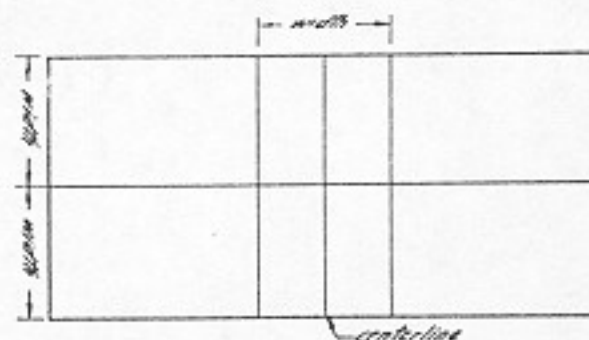


Fig. 207. Layout of cross-lap joint; first step.

Some of its uses are: crossrails, both plain and shaped, for taborets, tables, and cabinets; crosses for the base of hall trees, flower-pot stands, trellises, and graves. In carpentry cross-lap joints are used in window and heavy-timber construction, and in patternmaking for spokes for pulleys and wheels.

In most cases the members of a cross-lap joint are of the same thick-

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ness, width, and length, and cross each other in the middle at an angle of 90 deg. This, however, is not always the case. Members of cross-lap joints may be of different dimensions and may cross each other at any angle and at any point. The first and most common type is described in the following.

1. It is extremely important that the two members of the joint are of exactly the same length and width and that their ends are square.

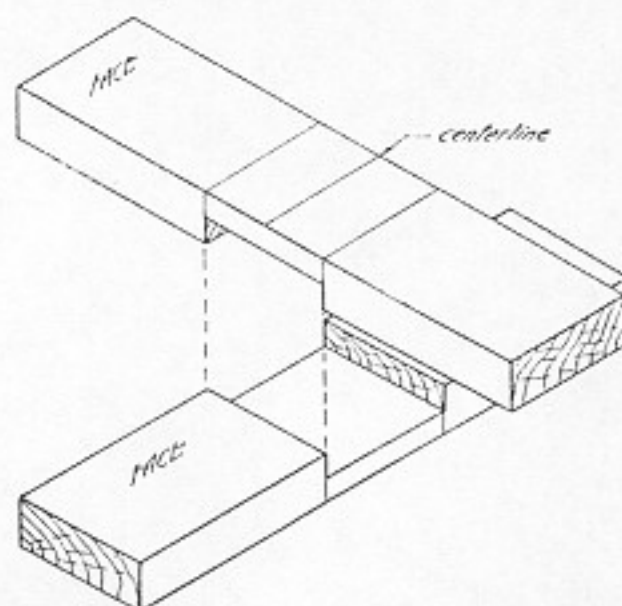


Fig. 208. Cross-lap joint.

2. Next in importance is that the joint is made exactly in the center of the pieces. First, the pieces are placed side by side so that their ends are flush, half their length is measured, and a line is squared across both pieces at this point (Fig. 207). This measurement is tested by reversing one of the pieces. When the ends are flush and the center lines meet, the measurement is correct. If the center lines do not meet, the length of the pieces has not been divided exactly in half.

3. The pieces are placed side by side, half their width is laid out on each side of the center line, and lines are squared across and all around

each piece at these points. This measurement is tested by placing one piece on top of the other. While in this position, the face of each piece is marked.

4. A marking gauge is set to half the thickness of the pieces, and depth lines are gauged *from the face of each piece* between the lines just marked.

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5. The parts to be cut away are marked (Fig. 195), and the waste wood is sawed and chiseled out as explained in Article 78, steps 4 to 7, and Figures 199, 200, and 201.

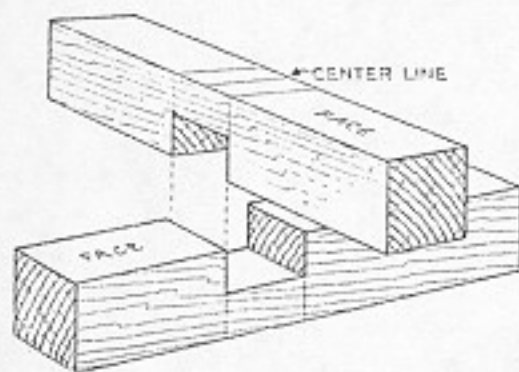


Fig. 209. Cross-lap joint on edges.

6. The pieces are then fitted together (Fig. 208). If they are too tight, they must not be forced together nor may material be chiseled off the shoulders, but a thin shaving should be planed off their edges.

7. The joint is finished by smoothing both sides with a sharp plane.

8. Cross-lap joints are often made on the edges of the wood instead of on the sides. The method of procedure is the same (Fig. 209).

QUESTIONS

1. In what pieces of furniture can a cross-lap joint be used?
2. How can you determine if the center lines have been marked correctly?
3. How can the layout of a cross-lap joint be checked?
4. If the joint is too tight, how should it be fitted?

Chapter X

DOWEL JOINTS

82. Making a Doweled Butt Joint Edge to Edge.
83. Making a Doweled Butt Joint End to Edge.
84. Making a Draw-Bolt Joint.
85. Locating Dowels by Means of Templates or Brads.

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Chapter X

DOWEL JOINTS

Dowel joints are used a great deal in modern furniture construction. It is a joint that is quickly and easily made, and for that reason is often considered inferior to the mortise-and-tenon joint, which, to a large extent, it has displaced.

Besides speed and ease in making, the dowel joint also has the advantage over the mortise-and-tenon joint in that its members are not weakened by the removal of too much material as is often the case with the former. At any rate, a well-made dowel joint is always superior to a poorly made mortise-and-tenon joint. In some types of construction as in an edge-to-edge joint and in curved work, the dowel joint is indispensable. Patternmakers use dowels in all split patterns.

Dowels are round pieces of wood manufactured in the same diameters as auger bits, that is, from 3/16 to 1 in. by sixteenths. On account of their strength and close grain, birch or maple is generally used for dowels. The standard length is 3 ft., but they may also be obtained in short working lengths, either with a smooth or a grooved surface. The purpose of the grooved surface is to allow glue and air to escape when the dowel is driven into the hole bored for it.

82. Making a Doweled Butt Joint Edge to Edge. When gluing boards edge to edge, as when making a table top, the joints are often re-enforced with dowels. These joints must be made carefully, however, because *dowels will not hold poorly jointed edges together*.

1. The boards are placed flat on the workbench in the position they are to occupy when the top is finished. In doing this, the following three factors are taken into consideration: the figure or pattern of the

grain, the heart side of the boards, and the direction of the grain.

2. If the boards are to be made into a table top, they are arranged so that the grain is combined into beautiful or pleasing patterns (Fig. 212). If a drawing board or a kitchen table is to be made, the figure of the grain may be disregarded.

3. The second consideration is to place the boards so that the "heart side" — the side of the board toward the center of the tree — is turned up. This is done to prevent warping in opposite directions. When boards dry, the greatest shrinkage is in the direction of the annual rings. This causes a pull tending to make the heart side convex (A, Fig. 213).

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4. If possible, the boards finally should be placed so that the grain runs in the same direction, that is, so that the glued-up table top can be planed in the same direction.

5. When the position of the boards has been determined, they are numbered on the face side as shown in B, Figure 213, and the direction is marked with an arrow.

6. The two edges marked 1 are placed together and they are jointed as explained in Article 37. The two edges marked 2 are then jointed, and finally the two edges marked 3.



Fig. 212. Boards arranged for a table top.

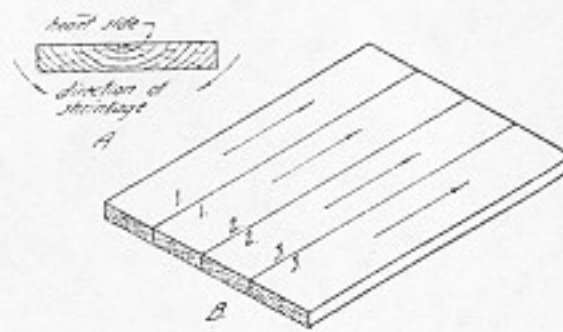


Fig. 213. Boards arranged with "heart side" turned up.

7. The boards now are placed side to side, and are clamped with a hand screw at each end. The number and position of the dowels to be used are determined, and lines are squared all around the boards at these points (Laying-Out Operation 12 and Fig. 214).

8. The hand screws are taken off the boards, a marking gauge is set to half their thickness, and the boards are gauged across the lines *from the face of each board*, but not the two outside edges (Fig. 214).

9. A little hole is made with an awl where the gauge lines and the pencil lines intersect. These small holes help to center the auger bit quickly and exactly.

10. The holes are bored with a dowel bit or an auger bit of the same diameter as the dowel to be used. This generally is from one third to one half the thickness of the wood. All holes should be bored to a uniform depth — in this case about 1 in. — for which a gauge is used (Boring Operation 59).

11. Great care must be taken to bore the holes perpendicular to the surface, otherwise the joint will not fit properly. A try-square placed as shown in Figure 215 is a great aid. It also is advisable to "sight" the work after every few turns of the brace to correct any error in direction before the hole is too deep.

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12. The boring may be facilitated by using a doweling jig (Fig. 216), which is a tool that enables anyone to bore a straight and perpendicular hole. It can be clamped over the edge of a board and is furnished with cylindrical guides of different diameters for the bits (See also the wooden doweling jig, Fig. 223).

13. The dowels are cut to length, 1/8 in. shorter than the combined depth of the two holes in which they are to fit. If a dowel is made too short, its holding power is diminished and the wood around the part of the hole not filled is likely to shrink, thereby causing a depression in the surface (Fig. 217).

14. Before the dowels are glued, they are pointed slightly with a knife or a piece of sandpaper. A dowel pointer, which is a tool resembling a pencil sharpener, is more satisfactory when a large number of dowels has to be pointed. If the dowels are smooth, a groove is cut lengthwise to permit the glue in the hole to escape.

15. The holes must be countersunk slightly so that the wood will

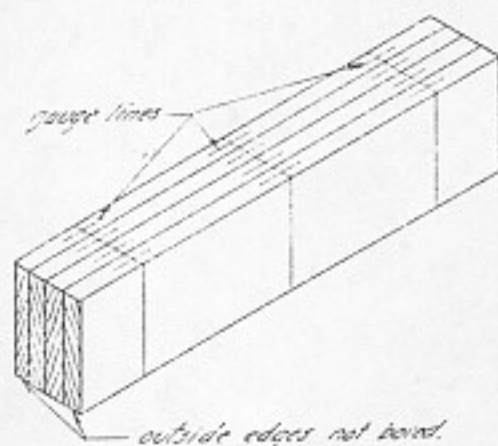


Fig. 214. Doweling boards edge to edge. Note how the boards are gauged across the lines from the face of each board, but not the two outside edges.



Fig. 215. Boring hole for dowel using gauge for depth and try-square for direction.

not be forced up around the dowels when they are driven home.

16. Glue is put in the holes on one edge of a board, one end of the dowels is dipped in glue, and they are driven into these holes. The

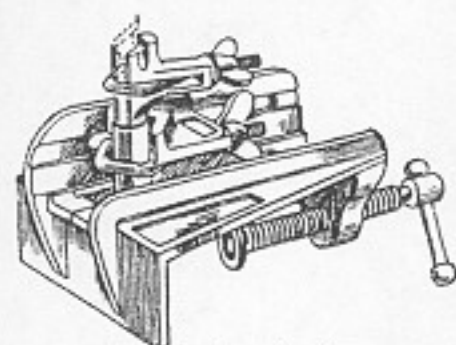


Fig. 216. Doweling jig.

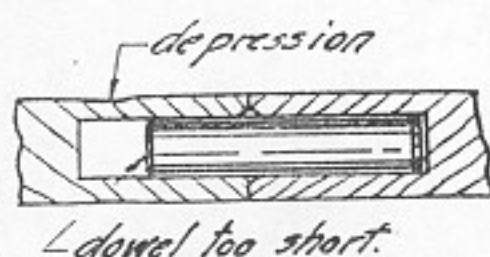


Fig. 217. Depression in surface caused by too short dowel.

surplus glue around the dowels is then wiped off. Glue is spread rapidly over the edges and around the projecting dowel pins, and some glue is forced into the rest of the holes. The work is put together and clamps are applied quickly (Gluing Operations 100 and 101).

QUESTIONS

1. What are dowels made of, and in what lengths and diameters are they obtainable?
2. When doweling boards edge to edge, how is the position of the dowels located?
How should the boards be placed with reference to the grain? What is the heart side of a board?
3. How can an auger bit be centered quickly and exactly?
4. How is the diameter of the dowel to be used determined?
5. What is likely to happen if a dowel is much shorter than the combined depth of the holes?
6. Why should a dowel be pointed and grooved before gluing?
7. What is the object in countersinking the holes?

83. Making a Doweled Butt Joint End to Edge. This type of dowel joint is made in a similar way as the edge-to-edge joint. Holes are bored opposite each other in both members into which the dowel pins are glued. This type of dowel joint is used more than any other in the manufacture of chairs, tables, and other framed structures. When making a doweled frame the procedure is as follows:

1. The pieces are squared to dimensions, and their faces are marked. It is very important that the crosspieces are of exactly the same length and that their ends are square. They should be sawed accurately and their ends planed on the shooting board, Figure 106.

2. A marking gauge is set to half the thickness of the stock, and a center line is gauged on the end wood of the horizontal crosspieces and another line on the inside edges of the vertical pieces at the place

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where they are to be joined. *These lines are gauged from the faces of all the pieces.*

3. The number and location of the dowels is determined. If two are used in each joint as in Figure 218, the marking gauge is set equal to the distance between the outside edge and the center of the first hole. Lines are gauged crossing the center lines on both ends of all four pieces. *Gauging is done from the outside edges only.*

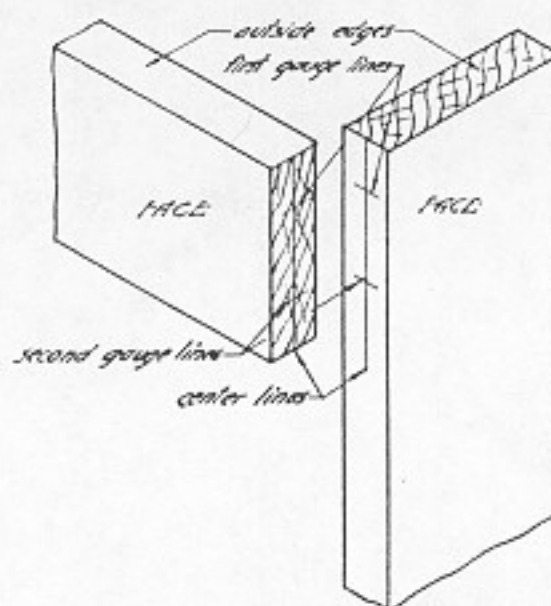


Fig. 218. Layout of doweled butt joint.

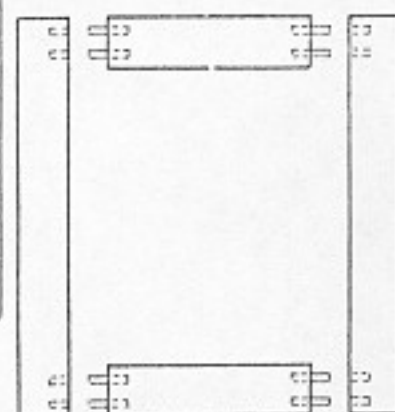


Fig. 219. Doweled frame ready for gluing.

4. The marking gauge is now reset so that the distance between the block and the spur is equal to the length between the outside edge and the center of the second hole. Another series of lines is gauged as before, remembering *always to gauge from the outside edges.*

5. The holes are bored, the dowels are prepared, and the frame is glued together as explained in Article 82, steps 6 to 9 (Fig. 219).

6. In cases where the members of the frame do not come flush, such as in a plain table, the center lines are gauged with different settings of the marking gauge. The ends of the rails or cross members are gauged along the center as explained in step 2. If these are $\frac{3}{4}$ in. thick, the marking gauge is set to $\frac{3}{8}$ in. (Fig. 220).

7. If the rails are to be set back $\frac{1}{4}$ in. from the face of the leg, $\frac{1}{4}$ in. must be added to the setting of the marking gauge, making it $\frac{5}{8}$ in. The center lines for the dowels are now gauged *from the outside edges* of the legs with this setting of the gauge. The cross lines intersecting

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the center lines are gauged from the upper edge of the rails and the upper end of the legs as explained in steps 3 and 4.

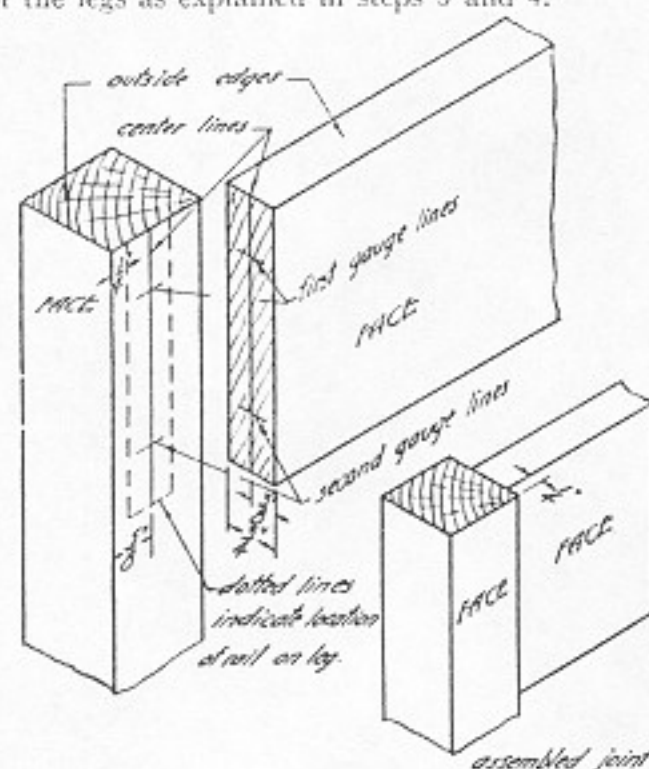


Fig. 220. Dowel joint between table leg and rail.

84. Making a Draw-Bolt Joint. A draw-bolt joint (Fig. 221) is used in timber construction which is subject to strain or vibration as when used for a workbench or a stand for a motor or machine. It has the advantage that it can be tightened when it works loose.

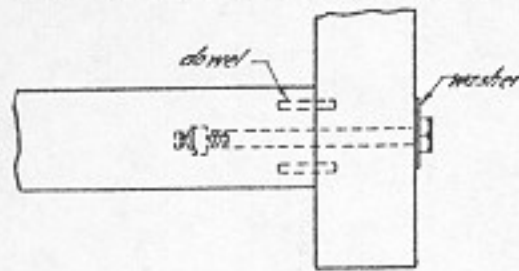


Fig. 221. Draw-bolt joint.

2. The pieces are assembled and the hole for the bolt is bored through both pieces. This hole is bored in the center of the horizontal piece, and should be of the same diameter as the bolt and a little longer.

3. A hole now is bored or chiseled in the horizontal piece for the nut of the bolt. The distance from the end should be such that the end of the bolt will pass completely through the nut so that it gets a good grip. This hole may be chiseled all the way through the piece or it may be chiseled from one side only. Sometimes it is blocked up so that the nut is concealed inside.

4. A washer is placed under the head of the bolt to prevent it from digging into the wood when it is tightened.

QUESTIONS

1. What is the advantage of a draw-bolt joint?
2. In what type of construction are draw-bolt joints used?
3. What other joint does a dowel joint most resemble?
4. How do these two joints compare as to strength and ease of construction?
5. When locating the holes for a doweled frame, from what faces and edges must the gauging be done?
6. The rails and legs of a plain table are to be doweled together. The rails are $\frac{3}{8}$ in. thick and are to be set back $\frac{3}{16}$ in. from the faces of the legs. How should the marking gauge be set for gauging the center lines in the legs?

85. Locating Dowels by Means of Templates or Brads. It is not always possible to gauge the lines necessary for locating dowels. In such cases templates generally are used.

1. Stiff cardboard is used for making the template. It is made of the same size as one of the members to be doweled, the center line is laid out, and holes are pricked through it at the points where the dowels are to be located.

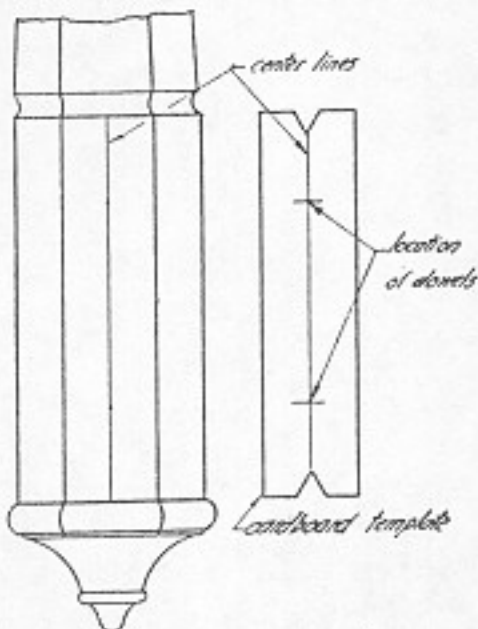


Fig. 222. Locating dowels with a template.

2. The triangular pieces are cut out of the template as shown, to help locate it directly over the center lines laid out on the stock, and the holes are pricked with an awl (Fig. 222).

3. Templates also may be used when the top of a taboret or a small table is to be doweled to the framework. Another method is to locate the dowels on the framework and drive small brads at all these points. The heads of the brads are cut off with a pair of cut-

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ting pliers, the top is placed carefully in position, and it is pressed down on the frame. The small holes left by the brads, both in the top and the frame, are the centers of the holes to be bored for the dowels.

4. When many pieces have to be bored exactly alike, as for example legs for a number of stools or tables, one of these is laid out carefully and then a doweled jig is constructed in which the legs fit snugly.

Holes now can be bored accurately through the guide piece without previous measuring and marking. Figure 223 shows a jig for

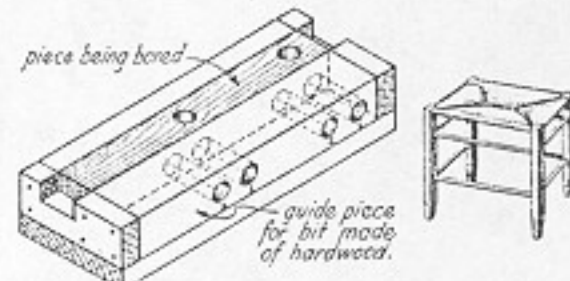


Fig. 223. Jig for boring holes in legs of stool.

boring holes in the legs of a stool. Two sets of holes are bored, so that the dowels joining the ends and those joining the sides of the stool are at different levels.

5. If it is desired to make a stool with a rush seat, as shown in the sketch, it is necessary that the dowels, over which the seat is woven, are at the same level and therefore meet in the holes. In this case their ends are cut at an angle of 45 deg.

QUESTIONS

1. What is understood by a template?
2. Why are two triangular pieces cut out of the template shown in Figure 222?
3. When a table top is to be fastened to the frame with dowels, how can their position be located?

Chapter XI

MITER JOINTS

87. Cutting a Miter Joint.
88. Nailing a Miter Joint.
89. Making a Doweled Miter Joint.
90. Making a Slip-Feather Miter Joint.

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Chapter XI

MITER JOINTS

A miter joint resembles a butt joint in that its members are fitted together without cutting or shaping. It differs from a butt joint in that the pieces are joined at an angle less than 90 deg.

Miter joints are used in picture frames and on all kinds of moldings, on furniture, doors, windows, interior and exterior trim.

A miter joint is a neat but weak joint and must, therefore, be reinforced with nails, glue, dowels, or splines.

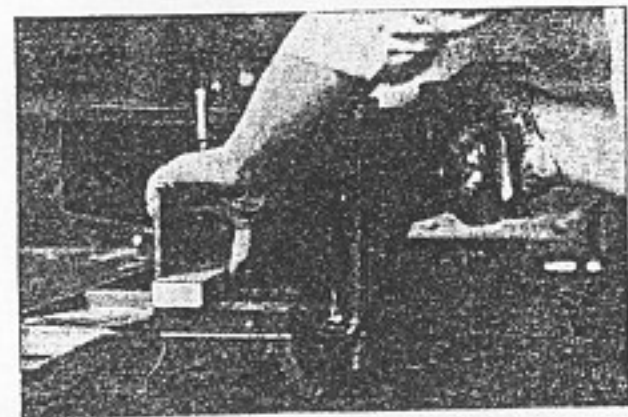


Fig. 226. Sawing picture-frame molding in miter box.

87. Cutting a Miter Joint. 1. The most common miter joint is cut at an angle of 45 deg. This angle may be found by drawing the diagonal of a square, but a simpler way is to use a tool called a miter box. Miter boxes are made both of iron and wood; in fact, a woodworker often makes his own miter box.

2. The iron miter box consists of a cast-iron frame fitted with a large backsaw, which is held in two adjustable metal guides. The saw moves on a graduated quadrant, which is notched at the most used angles. Iron miter boxes also have adjustable stops, which can be set so that any number of pieces can be cut to the same length and angle.

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3. A wooden miter box consists of a bottom piece, to which two side pieces are fastened. It is usually made to cut angles of 45 and 90 deg. only.

4. If a picture frame is to be cut in an iron miter box, the saw

carriage is set to 45 deg. on the left side of the graduated arc, the back of the molding is held against the vertical side of the box with the left hand, the saw is grasped with the right hand, and a small piece is sawed off the end of the molding. The rabbeted side of the molding always should be toward the worker while cutting in the miter box (Fig. 226). It is very important to hold the molding firmly while sawing. If it cannot be held by hand, it may be clamped to the sides of the miter box with a hand screw (Fig. 227).

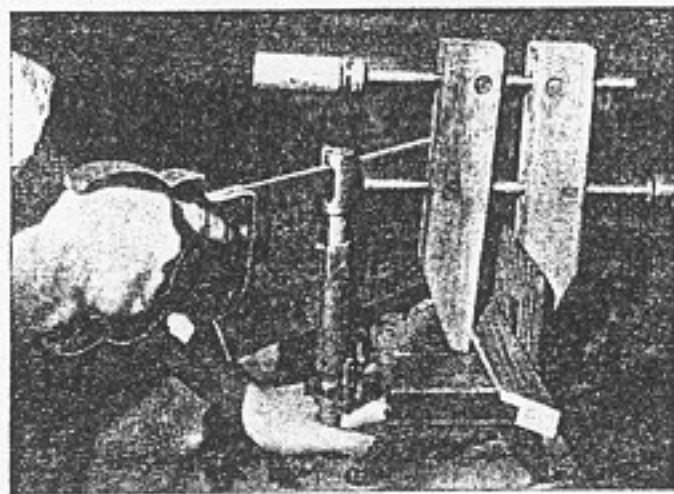


Fig. 227. Sawing picture-frame molding in miter box. Molding clamped to side of box with a hand screw.

5. The length of the picture or the glass is measured, and twice the width of the molding is added to this, measured on its underside from the rabbet to the back. This total length is laid out on the back of the molding (Fig. 228).

6. The saw carriage now is moved over to the 45-deg. mark on the right side of the quadrant. The back of the molding is held against the side of the box, and it is sawed on the waste side of the line marked. Short pieces of molding should be clamped to the side of the box, because it is awkward to hold them with the left hand when the saw is at the right end of the miter box (Fig. 227).

7. The saw carriage again is moved over to the left 45-deg. mark on

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the quadrant, and a triangular piece is sawed off. A similar piece goes to waste between each length of molding sawed.

8. From this cut, another piece of molding is measured equal in length to the first one, the saw carriage is moved over to the right side, and the molding is cut. It is important that the two pieces are of exactly the same length. If several pieces are to be cut to the same length, the adjustable stop is used.

9. The width of the picture or glass is measured, and the remaining two pieces of molding are cut in the same manner.

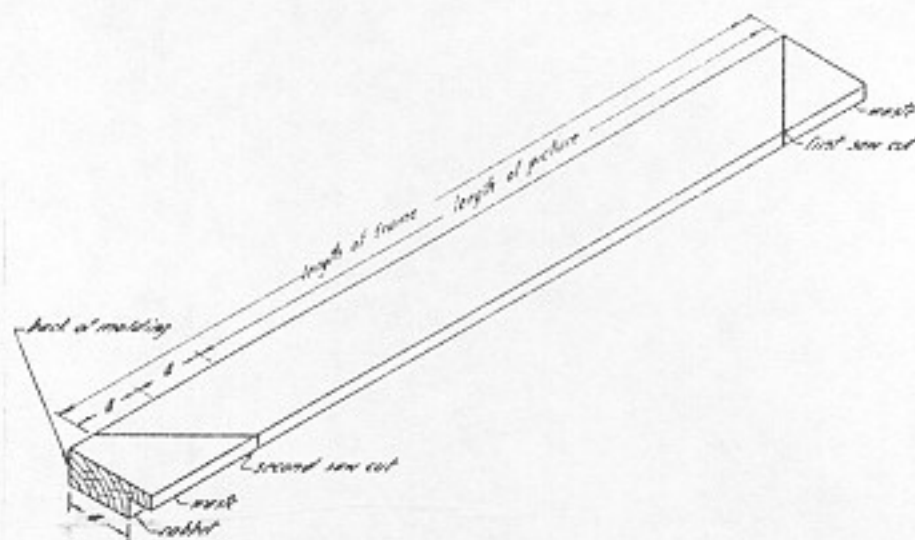


Fig. 228. Finding length of picture-frame molding.

QUESTIONS

1. What is the difference between a miter joint and a butt joint?
2. In what types of construction are miter joints used?
3. What angles can be cut in an iron miter box?

4. Which edge of a rabbeted picture-frame molding is held against the side of a miter box when sawing?

5. How is the length of a picture molding found?

88. **Nailing a Miter Joint.** Miter joints are often nailed together, especially by carpenters and picture-frame makers. The latter, however, have special clamping devices which hold the pieces firmly while they are being nailed.

1. The pieces are put together, the angles are tested, and the joints are inspected before nailing. If they do not fit, the pieces are tested for length.

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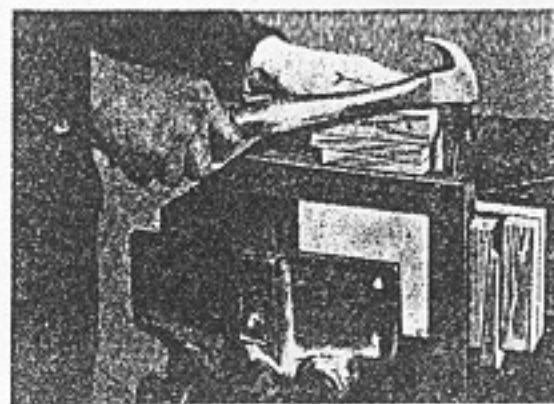


Fig. 229. Nailing a miter joint clamped in a jig.

2. A jig is made as shown in Figures 229 and 230, and the miter joint is clamped with double wedges as shown. The nails are driven from both sides of the joint and perpendicular to the outside edges. This device holds the pieces firmly and prevents any distortion or unevenness that is likely to occur when one of the pieces is held by hand during the nailing process.

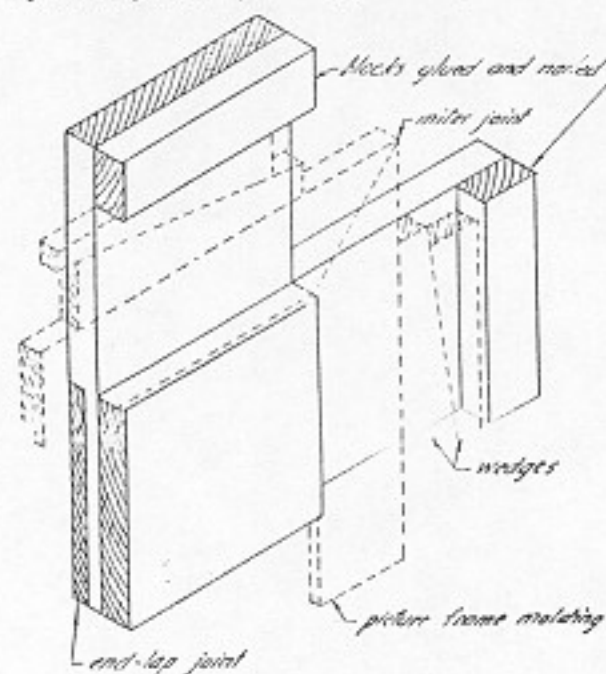


Fig. 230. Jig for nailing miter joint.

3. A nailed miter joint is stronger if a little glue is applied to the surfaces at the time of nailing. The nails are set below the surfaces with a nail set, and the holes are filled with crack filler or plastic wood.

QUESTIONS

1. What precaution must be taken before nailing a miter joint?
2. What kind of nails should be used?

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89. **Making a Doweled Miter Joint.** Doweled miter joints are used on large, plain frames rather than on shaped moldings.

1. The miters are cut and the pieces are placed in position to test joints and angles.

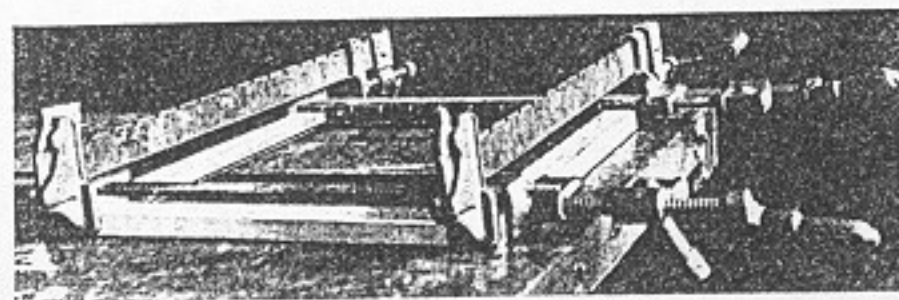


Fig. 231. Clamping mitered frame with four bar clamps.

2. A center line is gauged along the ends from the face of all the pieces. The position of the dowels is laid out either by gauging across this line (Dowel Joints, Art. 83, steps 1 to 4) or by using a template (Dowel Joints, Art. 85, steps 1 and 2).

3. The holes are bored at right angles to the face of the joint, using a depth gauge on the bit (Boring Operation 59).

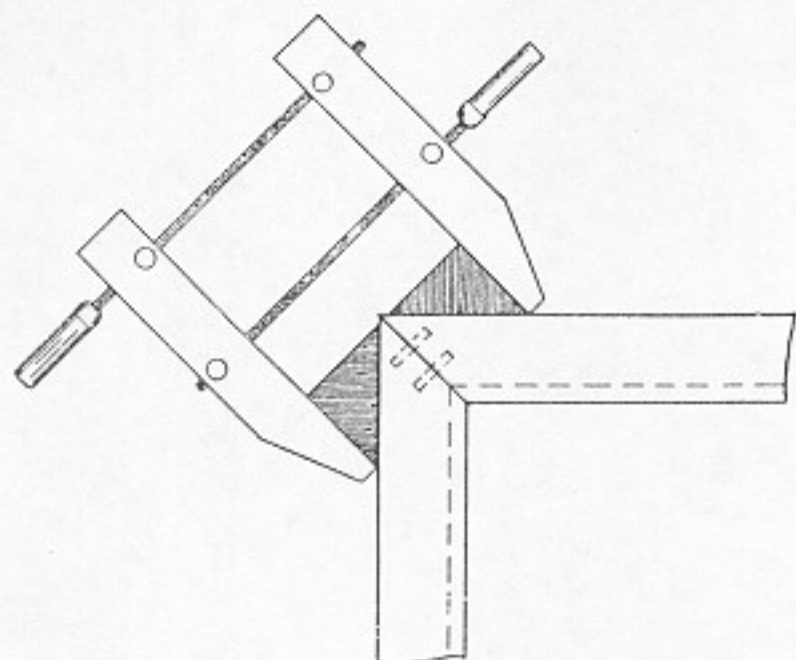


Fig. 232. Clamping mitered corner with a hand screw. Triangular blocks glued to outside edges.

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4. The dowels are glued into half the number of pieces (in an ordinary frame, two), the surplus glue is wiped off, and all the pieces are glued together.

5. An ordinary frame is clamped with four bar clamps. All clamps are placed at the corners, two of them at right angles to the other two (Fig. 231).

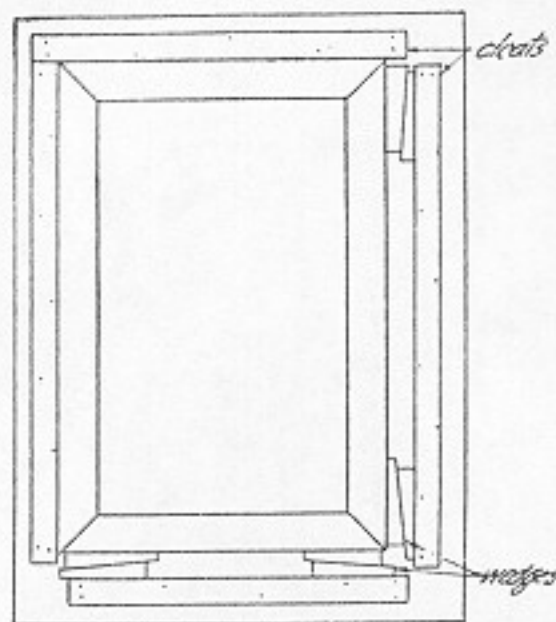


Fig. 233. Gluing a picture frame by wedging.

QUESTIONS

1. For what kind of work is a doweled miter joint suitable?
2. How can miter joints be clamped while gluing?

90. Making a Slip-Feather Miter Joint. This joint is especially useful on plain picture-frame moldings, such as can be made in the school shop. It makes a very strong and neat-looking miter joint.

1. The miters are cut, the pieces are placed in position, and the angles and joints are tested.

2. The frame is glued together. This may be done as shown in Figure 231, or by nailing four cleats to a board, as shown in Figure 233. The joints then are forced together by driving four double wedges at the three corners. A piece of paper is placed below each joint to prevent the frame from sticking to the board.

3. When dry, the wedges are loosened and the frame is carefully removed from the board. It is clamped in a bench vise and a saw cut is made in each corner (Fig. 234). A piece of veneer or other thin wood is glued and clamped into each corner. These pieces should fit tightly

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in the saw cuts, and their grain should run at right angles to the miter joint (Fig. 235).

4. After the frame is dry, the projecting parts are trimmed off at each corner with a chisel. Then the edges and faces of the frame are planed, and it is sanded and finished (Art. 117).



Fig. 234. Making saw cuts for splines.

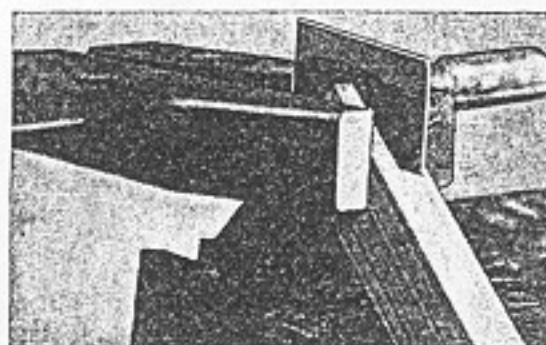


Fig. 235. Gluing splines.

QUESTIONS

1. How can an ordinary mitered frame be held securely together while gluing?
2. What is the advantage of a double wedge over a single wedge?
3. What is a "slip feather" and how does it reinforce the miter joint?
4. Why should the grain in a slip feather run at right angles to the miter joint?

Chapter XII

MORTISE-AND-TENON JOINTS

92. Making a Blind Mortise-and-Tenon Joint.
93. Making a Haunched Mortise-and-Tenon Joint.
94. Making a Through Mortise-and-Tenon Joint.
95. Making a Slip Joint.
96. Making a Keyed Mortise-and-Tenon Joint.
97. Making a Paneled Structure.

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Chapter XII

MORTISE-AND-TENON JOINTS

The mortise-and-tenon joint is, no doubt, the oldest, strongest, and most appropriate method of joining two pieces of wood together. It is used extensively in all good cabinetwork, in carpentry and interior woodwork, and also in patternmaking.

The mortise-and-tenon joint is made with many variations, some of the most important being the blind, the through, the haunched, the keyed, and the slip joint. All mortise-and-tenon joints consist of two parts, the "tenon," which is a rectangular projection on the end of one member, and the "mortise," which is a rectangular hole chiseled on the edge or side of the other member, and into which the tenon is fitted.

92. Making a Blind Mortise-and-Tenon Joint. This joint is used

mostly in cabinetwork, because it is neater in appearance than the other types. In a blind mortise-and-tenon joint, the tenon is concealed within the other member. The processes of making a mortise-and-tenon joint may be divided as follows: laying out, making the mortise, making the tenon.

Laying Out. 1. The pieces are squared to dimensions and their faces are marked. The tenon is called member A, and the mortise, member B (Fig. 238).

2. The length of the tenon is laid out on piece A, and a line is squared all around it at this point. In ordinary cabinetwork, tenons usually are from $\frac{3}{4}$ to 2 in. long, depending upon the size of the members. The longer the tenon is the more holding power it has.

3. The total width of piece A is laid out on piece B, and a line is squared all around it at this point. In this case the width of A is laid out from the end of B.

4. The thickness of the tenon is determined. This usually is from one third to one half the thickness of the stock. The points of a mortise gauge (Laying-Out Operation 14) are set to this distance, and the head is adjusted so that the double line will be marked in the middle

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of piece A. Piece A is gauged on the end and edges *from the face*, as far as the line squared around it.

5. The width of the mortise is the same as the thickness of the tenon, and should be gauged at the same time and from the face. If the pieces are to be flush on the face side, the setting of the mortise gauge is not changed. If the tenon member is thinner than the mortise member and is to join it in the center, as for example the rail and leg

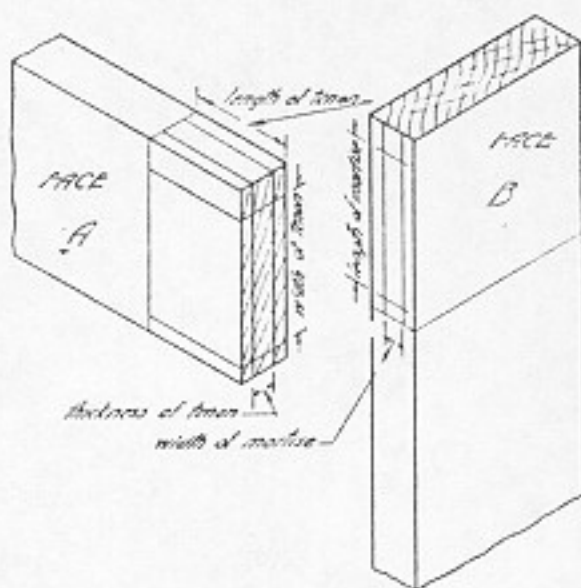


Fig. 238. Layout of blind mortise-and-tenon joint.

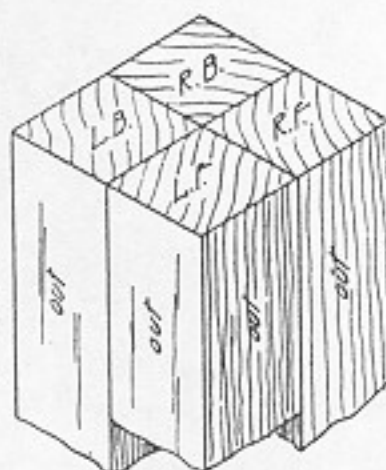


Fig. 239. Marking table legs before laying out mortises.

of a table, the block of the gauge is moved correspondingly, *but not the setting of the two points* (Dowel Joints, Art. 83, step 6, and Fig. 220).

6. A tenon usually is both thinner and narrower than the piece on which it is cut. This is done so that the mortise will be entirely covered when the joint is assembled. When the mortise is made at the end of the piece as in Figure 238, at least $\frac{1}{2}$ in. is taken from the width of the tenon to prevent the end wood of the mortise from tearing out. These measurements are laid out simultaneously on both the tenon and mortise members.

On ordinary work the width of the tenon usually is from $\frac{1}{2}$ to 1 in. less than the width of the tenon member. On pieces more than 8 in. wide, a double tenon is made in order not to weaken the mortise member by cutting too large a hole (Fig. 256).

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7. In mortise-and-tenon construction there usually are several joints of the same dimensions to be made. In order to make a good job, *all these joints are laid out at the same time before changing the setting of the gauge* (Fig. 240).

8. When laying out the mortises and tenons on a table, stool, or other structure having four legs, the legs are placed together and are marked right front, left front, right back, and left back. To further

guard against mistakes, the outside surfaces are marked "out." The mortises are gauged from these outside surfaces (Figs. 239 and 240).

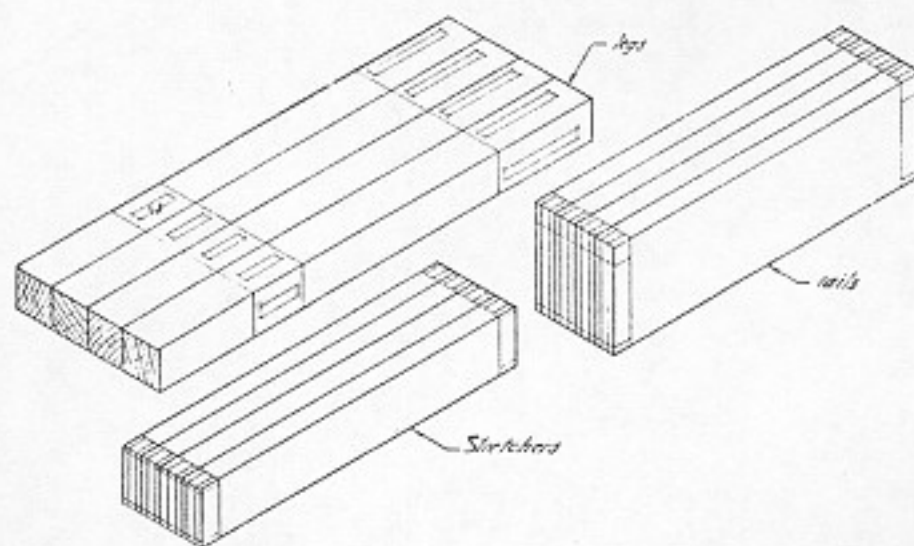


Fig. 240. Layout of mortises and tenons for small table.

Summary of laying-out processes:

- The length of all the tenons is marked, and lines are squared all around.
- The total width of all the tenon members is marked on the mortise members, and lines are squared all around.
- The thickness of all the tenons is gauged.
- The width of all the mortises is gauged with the same setting of the gauge.
- The width of all the tenons is marked and laid out on all mortises.
- The work must be checked carefully before starting to cut.

Making the Mortise. 9. The mortise can be made in two ways, either by boring a series of adjoining holes and cleaning out the re-

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maining wood with a chisel, or by making the hole entirely with a chisel.

10. Using the first method, the piece is clamped in the bench vise, and a line is gauged exactly in the center between the two lines already



Fig. 241. Boring series of holes for mortise.



Fig. 242. Cleaning out bored mortise with chisel.

gauged for the mortise. A number of holes are bored as closely together as possible along this center line using an auger bit or a dowel

bit of the same diameter as the width of the mortise. A gauge is used on the bit (Boring Operation 59) so that the holes are all bored to the same depth, which should be slightly more than the length of the tenon. Care must be taken to bore the holes straight (Fig. 241).

11. The small pieces of wood left between the holes are chiseled out. A chisel with a short, wide blade is used for the sides of the mor-

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tise, and a narrow chisel for the ends. The chiseling must not go beyond the gauge lines (Fig. 242). If the bit has gone a trifle outside the gauge lines here and there, this will not be seen when the joint is finished and will not materially affect its strength.



Fig. 243. Chiseling a mortise. Paper strip glued around chisel as depth gauge.

12. Using the second method, a mortise chisel of the same width as the mortise is selected. A mortise chisel is very thick below the handle to prevent it from breaking when the shavings are forced out of the hole (Fig. 130). The piece is clamped on top of the bench, and cutting is begun by chiseling out triangular pieces in the center of the mortise until the full depth is reached. A strip of paper glued around the chisel serves as a depth gauge (Fig. 243).

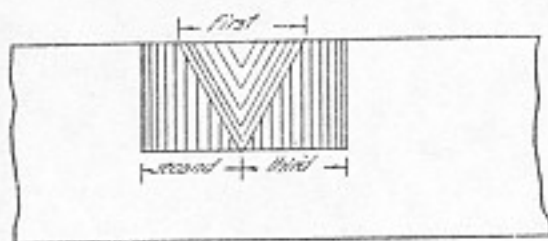


Fig. 244. Diagrammatic sketch of steps in chiseling a mortise.

13. The chisel is held perpendicularly with the bevel toward the center of the mortise which is chiseled to both ends (Fig. 244). The shavings are broken loose by pushing the handle toward the center of the mortise. A try-square placed alongside the work aids materially in making perpendicular cuts.

Making the Tenon. 14. The piece is clamped diagonally in the bench vise as shown in Figure 245. In this way the gauge lines on the end and on one side can be watched at the same time. A backsaw is used on small pieces. On large pieces a rip saw may be used. The piece is sawed outside the lines until the line marking the length of the tenon has been reached. The piece is reversed in the vise and is clamped in a vertical position with the edge not sawed toward the worker. When finishing the saw cuts it is only necessary to watch one gauge line,

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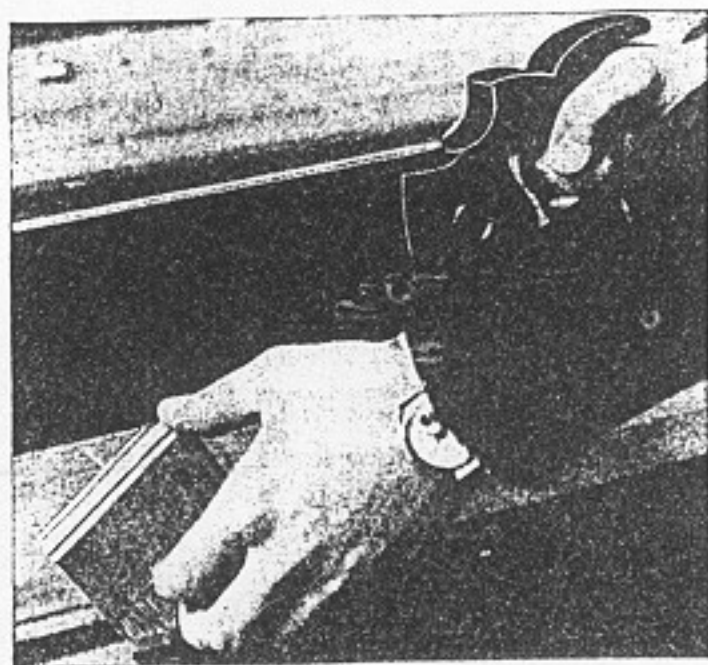


Fig. 245. Sawing cheek cuts of tenon.

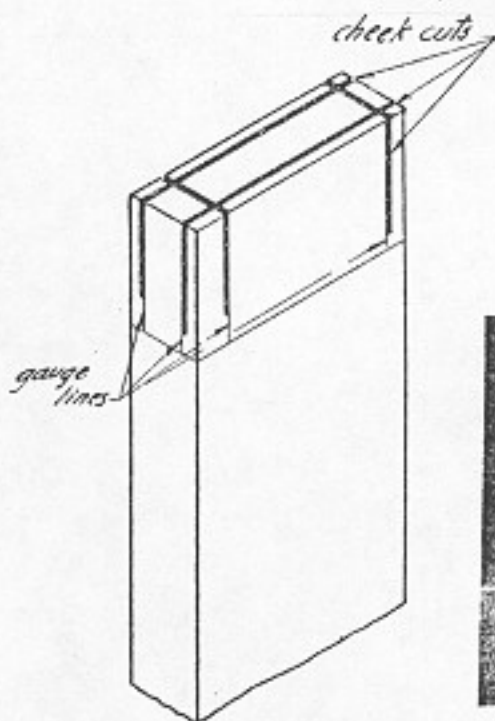


Fig. 246. Cheek cuts on a tenon partly sawed.

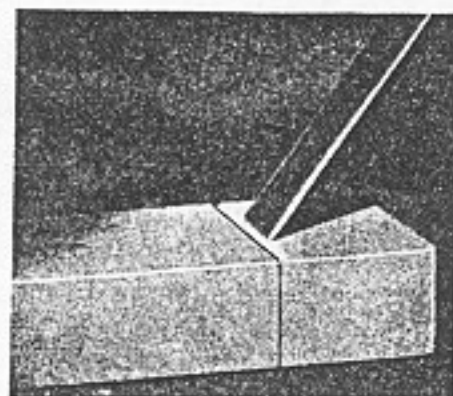


Fig. 247. Cutting triangular groove on tenon with bevel of chisel down.

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because the saw cut already made serves as a guide for the saw. These saw cuts are called *cheek cuts*.

15. Next, the other cheek cuts are sawed, marking the width of the tenon (Fig. 246).

16. Now the tenon member is sawed across the grain along the line squared around it. These cuts are called the *shoulder cuts*. As it is very

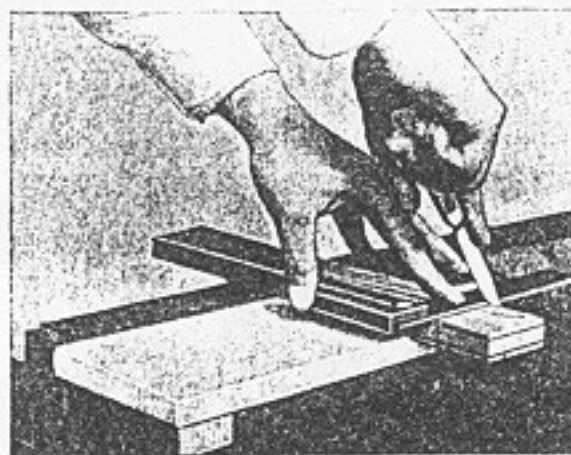


Fig. 248. Scoring line with knife.

important that the shoulders of the tenon are sawed straight and square, either a triangular groove is cut with a chisel, in which to start the saw (Figs. 247, 248, and 249), or a block is clamped right on the line to serve as a guide for the saw (Fig. 73).

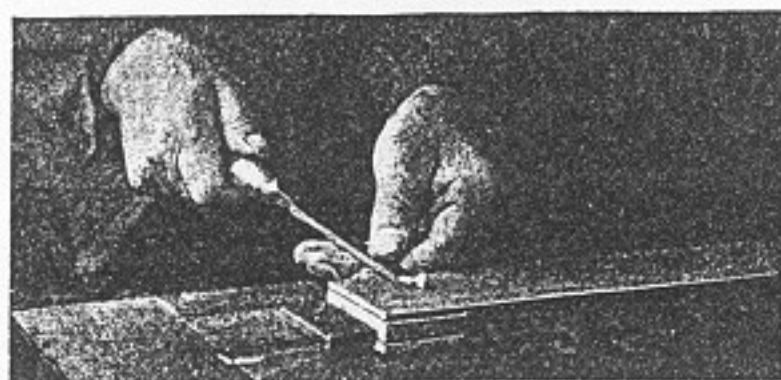


Fig. 249. Cutting triangular groove in which to start the saw.

17. The piece is clamped in a vise or it is held against a bench hook, and the shoulder cuts are made with a backsaw (Fig. 250).

18. Any unevenness is cleaned up with a sharp chisel, and the mor-

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tises and tenons are fitted together. The ends of the tenons are beveled slightly so that they will enter the mortises easily. If the tenon fits too tightly, the joint should not be forced together, but the sides of

QUESTIONS

1. What is understood by a blind mortise-and-tenon joint?
 2. Mortise-and-tenon joints are used on several different structures. What are four of these structures?
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3. How do the terms thickness, width, and length of the tenon correspond to the terms depth, width, and length of the mortise?
 4. What is the usual proportion between the thickness of the tenon and the total thickness of the stock?
 5. Why is it important to lay out all mortises and tenons in the construction at the same time?
 6. How is the depth of the mortise regulated by boring? by chiseling?
 7. Why should the piece be clamped on top of the bench instead of in the vise when the mortise is made entirely with the chisel?
 8. How is the tenon member clamped in the vise while the cheek cuts are sawed?
 9. How are the shoulder cuts on the tenon sawed?
 10. What is likely to happen if a too-tight-fitting mortise-and-tenon joint is forced together?
 11. What is a pinned mortise-and-tenon joint?

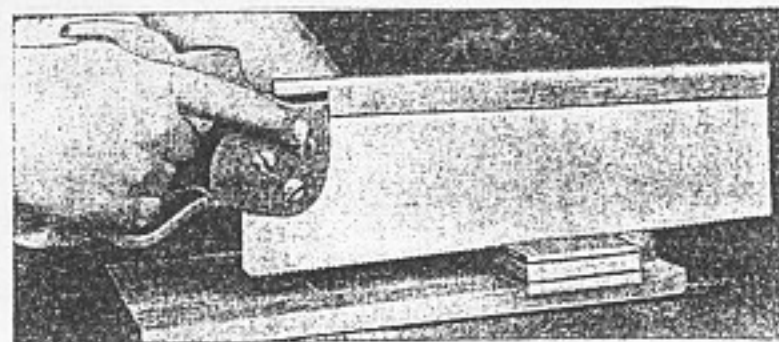


Fig. 250. Sawing shoulder cuts.

the mortise or the tenon should be pared with a chisel. The joint should fit so that it can be pressed together with the hands. Each corresponding mortise and tenon is numbered so that the joints can be correctly and rapidly assembled when gluing.

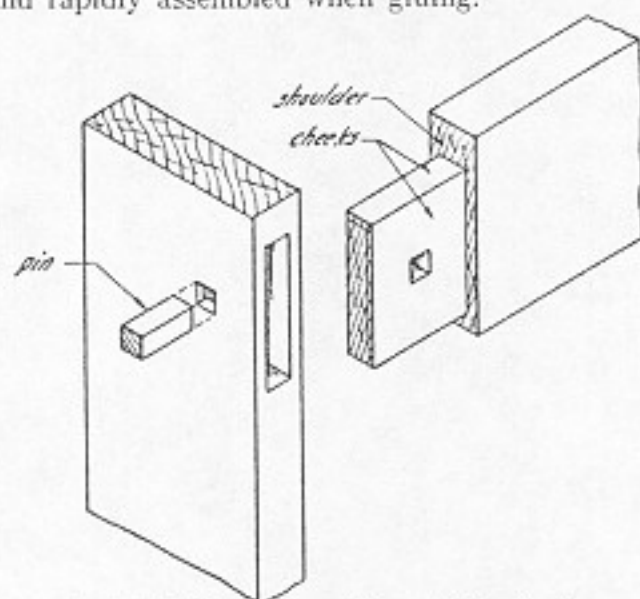


Fig. 251. Blind mortise-and-tenon joint with pin.

19. A blind mortise-and-tenon joint often is strengthened by driving a pin through it (Fig. 251). When the appearance is unimportant this

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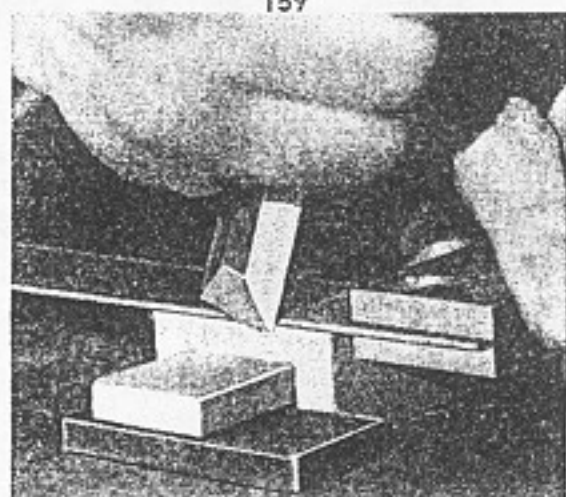


Fig. 252. Cutting line around shoulders of tenon with sharp chisel.

usually is an ordinary dowel, otherwise a square or triangular pin is used.

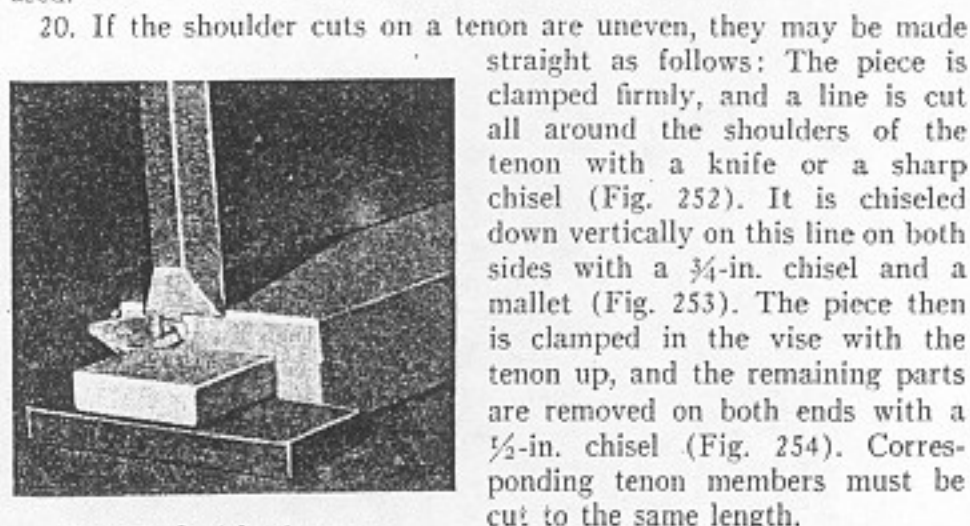


Fig. 253. Straightening uneven shoulder cuts with chisel.

20. If the shoulder cuts on a tenon are uneven, they may be made straight as follows: The piece is clamped firmly, and a line is cut all around the shoulders of the tenon with a knife or a sharp chisel (Fig. 252). It is chiseled down vertically on this line on both sides with a $\frac{3}{4}$ -in. chisel and a mallet (Fig. 253). The piece then is clamped in the vise with the tenon up, and the remaining parts are removed on both ends with a $\frac{1}{2}$ -in. chisel (Fig. 254). Corresponding tenon members must be cut to the same length.

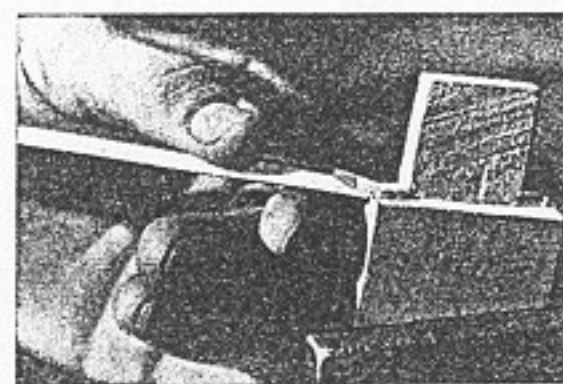


Fig. 254. Removing remaining parts on shoulder with chisel.

93. Making a Haunched Mortise-and-Tenon Joint. A haunched mortise-and-tenon joint is used when the pieces are grooved for a panel as in door construction. The advantage of this joint over the blind mortise-and-tenon joint is that it gives more lateral stiffness to the construction and fills the grooves on the end of the vertical pieces.

1. The pieces are squared to dimensions and their faces and inside edges are marked.
2. The grooves are plowed in the center of the inside edges, making them as deep as they are wide (Grooved Joints, Art. 71).
3. The mortises and tenons are laid out (Art. 92, steps 1 to 7), and are made the same width as the grooves. Instead of cutting the upper part of the tenon off flush with the shoulders, it should project so that it fills the groove when the joint is finished (Fig. 255).

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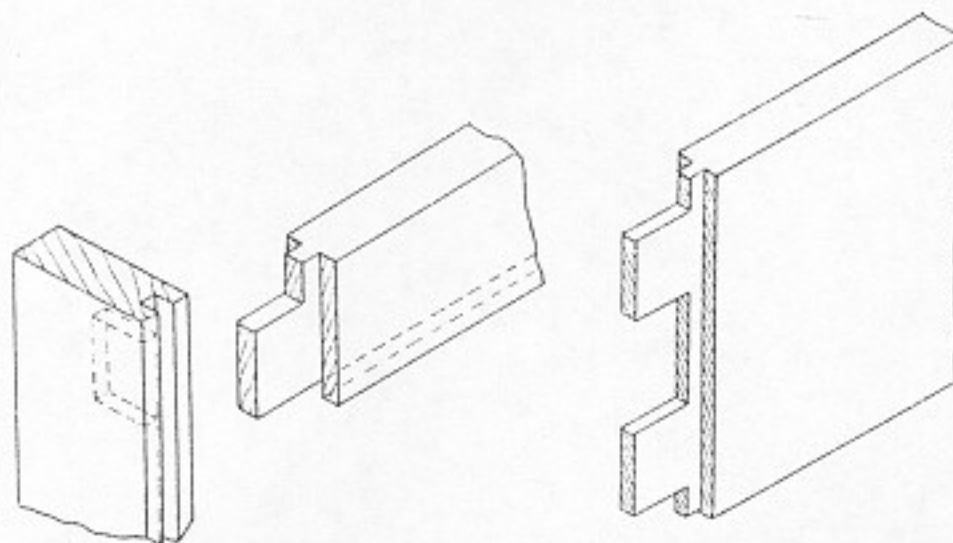


Fig. 255. Haunched mortise-and-tenon joint.

Fig. 256. Double haunched tenon.

4. A modified haunched joint is used in table construction and is called table or taper haunching. In this joint the projection on the upper part of the tenon is tapered (Fig. 257).

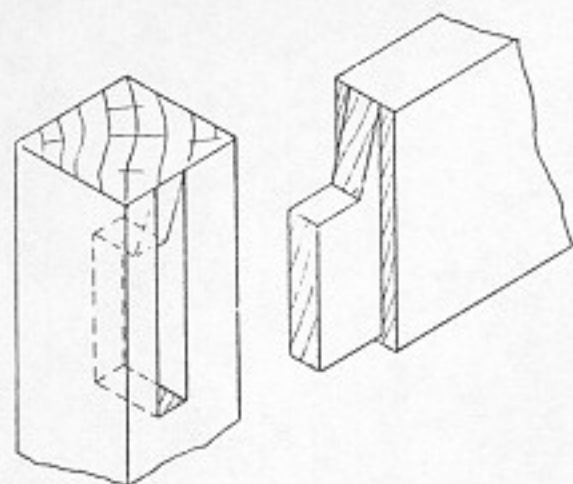


Fig. 257. Table haunching.

94. **Making a Through Mortise-and-Tenon Joint.** In this joint, as its name implies, the tenon extends through the mortise member.

1. This joint is laid out and made in the same manner as a blind mortise-and-tenon joint, but the mortise is chiseled from both edges.

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2. The tenon either is planed off flush with the mortise member, or it is left to project a little beyond the mortise and is rounded off.

3. In through mortise-and-tenon joints the tenons often are wedged.

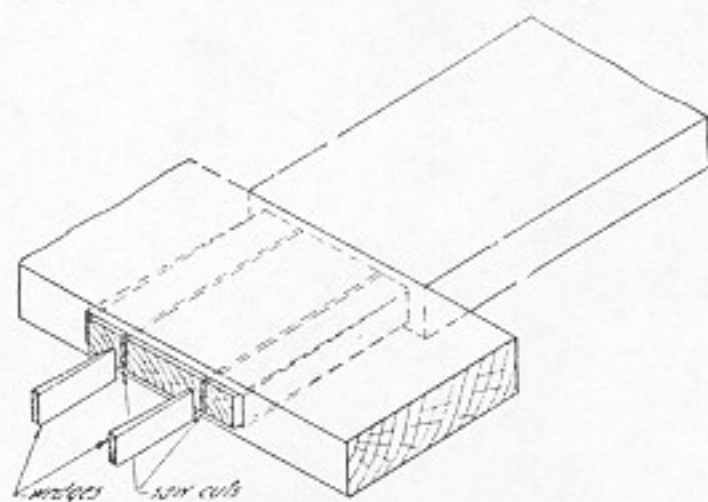


Fig. 258. Wedged mortise-and-tenon joint.

In such a case the mortise is made a little wider on the side where the wedges are driven so that the tenon cannot pull out (Fig. 258).

QUESTIONS

1. How is a through mortise-and-tenon joint wedged?
2. How long should the tenon be in a through mortise-and-tenon joint?

95. **Making a Slip Joint.** A slip joint is a through mortise-and-tenon joint where the mortise is made on the end of the piece. It is a very strong joint used to join the corners of all sorts of frames. This

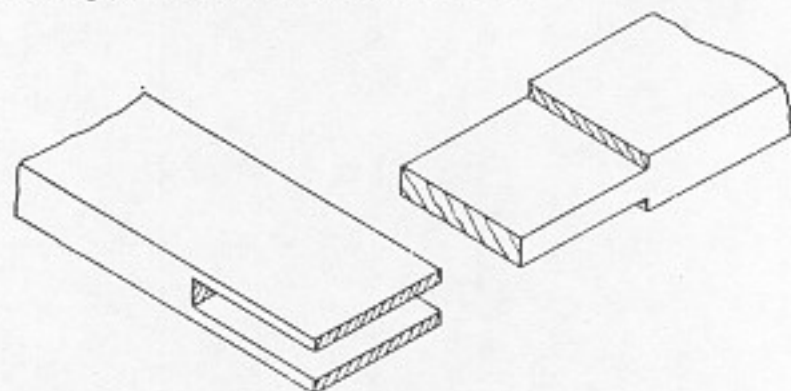


Fig. 259. Slip joint.

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joint can be used for the same purposes as the end-lap joint (Art. 76), but is much superior to it.

1. The joint is laid out as the blind mortise-and-tenon joint described in Article 92, but the tenon is made the full width of the stock.

5. A double tenon is made on the lower rail of a door if it is more than 8 in. wide. The joint is haunched both on the ends and between the tenons (Fig. 256).

QUESTIONS

1. How does a haunched mortise-and-tenon joint differ from an ordinary blind mortise-and-tenon joint?
2. What is the advantage of a haunched mortise-and-tenon joint?

2. The tenon, which has only two cheek cuts, is cut as described in Article 92, steps 14 to 18.

3. The mortise is sawed in the same way as the cheek cuts on the tenon, but in this case the saw cuts are made on the inside or waste side of the gauge lines.

4. The waste pieces are chiseled out and the members of the frame are fitted together. Chiseling is done halfway from each side (Fig. 259). When gluing this joint, the corners are clamped with a hand screw in the same way that a spline miter joint is clamped (Fig. 235).

QUESTIONS

1. How does a slip joint compare in strength with an end-lap joint or a dowel joint?
2. How is the mortise in a slip joint made?
3. Why must the saw cuts be made inside the gauge lines on a mortise, but outside the gauge lines on a tenon?

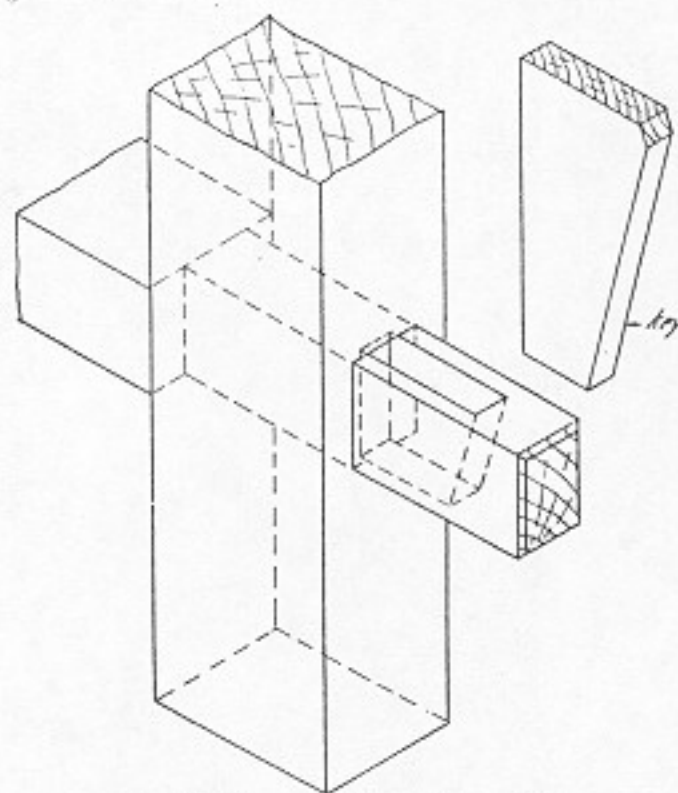


Fig. 260. Keyed mortise-and-tenon joint.

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96. **Making a Keyed Mortise-and-Tenon Joint.** This joint differs from the other mortise-and-tenon joints in that it can be taken apart. It is therefore useful in the so-called "knock-down" type of furniture.

1. The joint is laid out and made as a through mortise-and-tenon joint, but the tenon is made at least twice as long as the thickness of the stock through which it projects (Fig. 260).

2. The joint is assembled and a line is marked across the tenon at the point where it projects. A rectangular through mortise is laid out on the projecting part of the tenon, extending from $1/16$ to $1/8$ in. behind this line. This mortise then is bored and chiseled. The two sides and the inner end of the mortise are made perpendicular, but the outer end is chiseled at an angle so that the mortise is longer on top than on the bottom.

3. A key is made to fit this mortise, with one edge square to the two ends, and the other edge tapered to fit the angle at which the mortise was cut.

4. When the key is driven home its straight edge bears against the surface of the mortised member pulling the tenon through it and forcing the joint together.

QUESTIONS

1. What is the principal difference between a keyed mortise-and-tenon joint and other mortise-and-tenon joints?
2. Why does the mortise in the tenon extend behind the outside face of the mortise member?
3. How is the key made and fitted?

97. **Making a Paneled Structure.** A simple paneled structure (Fig. 261) consists of a central board, the panel, which is set into a frame, usually consisting of four pieces mortised together. The panel is generally made of thinner stock than the frame and is held in grooves cut

on the inside edges of the latter.

The advantages of this construction are that a frame does not twist or warp as a solid piece of wood, nor does it shrink or swell nearly as much. Because the panel moves freely in the grooves, it can shrink or swell without affecting the size of the frame. The only shrinkage or swelling therefore that can affect the size of the structure is in the comparatively narrow frame itself.

Panel construction is used a great deal both by cabinetmakers and carpenters. Typical examples are doors, chests, and wainscoting. A small cabinet door with a single panel is made as follows:

1. The stock for the frame is laid out, the two vertical members

being made about $\frac{1}{2}$ in. longer than the finished dimensions call for, and $\frac{1}{8}$ in. being added to the width of all four members to allow for squaring and fitting.

2. The inside edges of the frame are planed, and a groove is plowed through the center of these edges (Grooved Joints, Art. 71). The width of the groove should be about one third the total thickness of the stock. Its depth usually is made equal to its width.

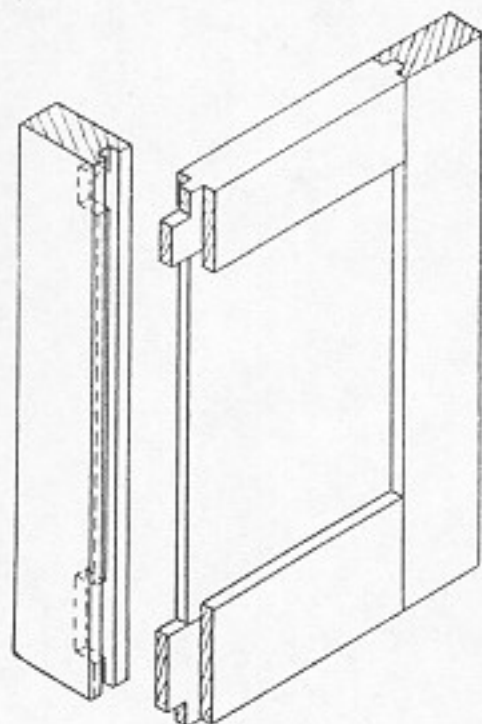


Fig. 261. Paneled structure, flat panel.

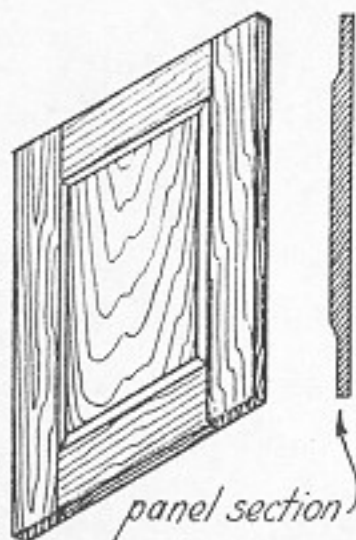


Fig. 262. Raised panel.

3. Haunched mortise-and-tenon joints are laid out in the four corners, and the mortises are made the same width as the grooves (Art. 93).

4. The panel is made either flat or raised (Figs. 261 and 262). Flat panels often are made of plywood. The panel should fit snugly in the grooves, not too loose and not too tight. It should be a little narrower and shorter than the inside width and length of the frame plus twice the depth of the grooves. This is to allow for expansion.

5. Only the mortises and tenons are glued. *Glue must not be put into the grooves or on the panel* as this will prevent it from moving freely under difficult climatic conditions. The frame is clamped together with

two bar clamps, one at each end, and it is tested for flatness and squareness with a steel square (Gluing Operations 100 and 103).

6. When dry, the surfaces of the frame are planed smooth and flat and the door is fitted to its opening.

QUESTIONS

1. What are the advantages of panel construction?
2. Under what conditions does wood shrink or swell?
3. Why are haunched mortise-and-tenon joints most suitable for a paneled structure?
4. Why should a panel never be glued into the grooves?

Chapter XIII

GLUING OPERATIONS

99. Glue and Its Preparation.

100. General Directions for Gluing.
101. Gluing Two or More Boards Edge to Edge.
102. Gluing Shelf Construction.
103. Gluing Square or Rectangular Structures.

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Chapter XIII

GLUING OPERATIONS

Wood is fastened together by various means. Of these, glue is the oldest, the neatest, the strongest, and most durable. It is used almost exclusively in cabinetmaking and patternmaking. It holds so well on side and edge grain that the joint can be made as strong as the wood itself. But it does not hold well on end grain, because the open wood cells absorb the glue.

99. Glue and Its Preparation. Several kinds of glue are used commercially. Of these the most important are animal glue, casein glue, vegetable glue, and blood-albumen glue. These glues have different characteristics and properties which determine their use for different purposes. Animal glue is most widely used for woodworking because of its strength, quick-setting, stainlessness, and free-flowing consistency. Casein glue, however, is gaining more and more in favor among woodworkers. It has the advantages of being strong, waterproof, and quickly prepared in small or large quantities of uniform quality. It has the disadvantage of staining certain kinds of wood, especially oak, mahogany, and redwood. A special nonstain casein glue, however, is now on the market.

1. *Animal glue* is made from the hides, bones, sinews, and other parts of animals. It is ground or made into sheets or flakes. Sheet glue, which is very hard and brittle, must be broken into small pieces with a hammer. If the sheet is put into a cloth or bag while it is being broken, the pieces will not be scattered all over the floor. A good glue is transparent and very brittle.

2. These pieces or flakes are now put into the glue pot, covered with clean, cold water and allowed to soak overnight. If it is a good grade of glue, the small, hard pieces when examined the following day, should have absorbed most of the water in which they were soaking, swelled to several times their original size, and be soft and jellylike. If they are only partly dissolved in the cold water, it indicates that the glue is of a poor grade.

3. The proportions of glue and water vary according to the grade of glue and the kind of wood to be glued. For example, a certain stand-

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ard grade of glue is mixed with water in the proportions of 1 part of glue to 2 parts of water for hard woods, and 1 part of glue to $1\frac{1}{2}$ parts of water for soft woods. These proportions always are obtainable from the manufacturers.

4. The glue and water are accurately weighed, and the glue pot and brushes carefully cleaned before a new batch is melted.

5. The glue then is heated. The old type of glue pot is just a double boiler with water in the outer pot. The modern glue pot has no water jacket, but is heated by electricity to a temperature of about 145 deg. It has been found that a higher temperature destroys the binding qualities of the glue. Repeated heatings also weaken the glue.

6. The glue loses in strength and becomes thicker through repeated heatings because the water evaporates. As the glue should be *quite thin and run freely from the brush* more water must be added until it is thin enough.

7. Instead of making a small quantity of fresh glue every day, a better way, when preparing a new batch of glue, is to make enough to fill the glue pot. When it is melted, it is poured out into a shallow dish or pan and allowed to cool. It can then be lifted out in one cake and a small portion,

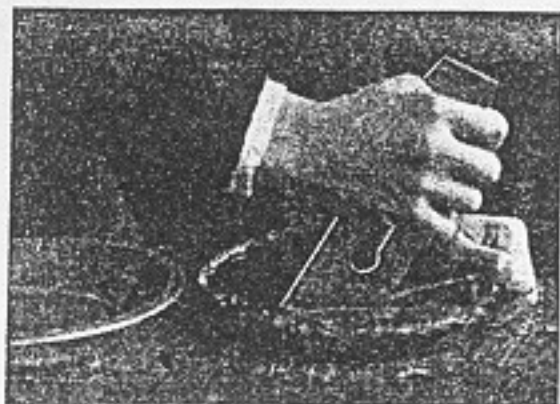


Fig. 265. Cutting cake of prepared glue.

in a tin can with a close-fitting cover to prevent evaporation.

8. *Casein glue* is made from the curds of milk to which certain chemicals are added. The finished product is a light-yellow powder.

9. It is mixed with an equal amount of *cold* water by volume. The quantity of glue powder needed must be measured and poured slowly into the water while stirring briskly for about one minute. The mixture must stand about 15 minutes and then be stirred again for one minute.

10. Casein glue is used much thicker than animal glue, and must therefore be spread with a very stiff brush. It is always used cold.

11. This glue cannot be kept from one day to the other, and the brush and container must be washed out at the end of each day.

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12. The strength of glued joints is increased if the surfaces are treated with caustic soda before the glue is applied. The following method of procedure is recommended by the Forest Products Laboratory at Madison, Wis.

13. A solution of 10 parts by weight of caustic soda to 90 parts of water is prepared and brushed on the surface to be glued. It is allowed to soak into the pores of the wood for 10 minutes, and then any remaining moisture or dissolved material is wiped off with a rag or a piece of cotton waste. It is set away to dry thoroughly and then is glued in the usual manner. This method may be used both with animal and casein glue.

QUESTIONS

1. What glues are most used by woodworkers?
2. How is animal glue prepared?
3. What are some of the characteristics of good animal glue?
4. A good mixture of casein glue consists of part of glue to part of by volume.
5. Which glue should be used on a job that cannot be clamped quickly?
6. How may a week's supply of animal glue be prepared?

100. General Directions for Gluing.

Animal Glue. When using animal glue, speed is of prime importance. It, therefore, is necessary to have the whole process planned in advance. The procedure is as follows:

1. The parts must fit perfectly before glue is applied. Thick glue will fill up a loose joint, but when it hardens it cracks and the joint falls apart. Therefore *in all gluing jobs the wood surfaces must fit tightly together*. It is strongly recommended to test the fit of all pieces by clamping them together beforehand without glue. By following this rule many serious mistakes are avoided.

2. The parts are numbered or marked clearly so that they can be put together quickly and correctly.

3. All clamps and hand screws needed for the gluing job are placed conveniently, and they are adjusted so that they can be put in place and tightened in the least possible time.

4. Softwood blocks that can be placed over finished sides and edges are prepared to protect the surfaces from being marred by the clamps.

5. One or two squares, a rule, a mallet, chisels, or a glue scraper are placed on or near the glue bench, because these tools are needed for most gluing jobs.

6. If the glue is of the right temperature and consistency it runs freely from a full brush. Too thick glue does not penetrate into the

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pores of the wood and, therefore, does not make a good joint. Two or three glue brushes of different sizes should be ready.

enough for one day's work, cut from it (Fig. 265). In this way there always will be fresh glue of a standard quality. The cake of prepared glue should be kept

7. The proper room temperature for gluing is not less than 70 deg. F. All doors and windows are closed to prevent chilling the glue. It is also advisable to warm the part to be glued to a little more than room temperature, especially in cold weather, because hot glue applied to a cold surface chills immediately. Chilled glue, like too thick glue does not penetrate into the pores of the wood and therefore does not make a good bond. Moreover, neither thick nor chilled glue can be properly squeezed out of a joint so that the wood surfaces can come together. Such a joint, therefore, comes apart when the glue hardens and cracks.



Fig. 266. Holding work over glue pot while applying the glue.

8. The glue is applied liberally and rapidly to both members of a joint. The worker must be careful not to smear the glue or drop it from a too full brush on finished surfaces. Some pieces, as the members of mortise-and-tenon joints, may be held over the glue pot while applying the glue, so that the excess can drip back into the pot (Fig. 266).

9. The pieces are driven together with a mallet, and the hand screws and clamps are applied with the least possible delay. On account of the speed needed in gluing, it is always well to have a helper.

10. The gluing job now is checked for tightness, squareness, and flatness, as the case may be, with the squares and ruler. Any necessary adjustments in the position of the clamps are made. The surplus glue, squeezed out around the joints, now has had time to chill and thicken and is removed with a chisel or glue scraper. Warm glue cannot be removed without smearing.

11. **Casein glue.** When using casein glue the method of procedure is about the same. Speed, however, is not so necessary, because casein glue does not begin to set until from 10 to 15 minutes after its application.

Likewise, the question of temperature is not of great importance, because casein glue is mixed with cold water.

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12. Casein glue is used much thicker than animal glue. A special brush with very stiff bristles is therefore necessary for spreading it thoroughly. Because casein glue is mixed fresh every day and used cold, there is no danger of evaporation. Its consistency always remains constant.

QUESTIONS

1. Why should wood surfaces to be glued always fit tightly together?
2. What are the effects of chilled or thick animal glue on a joint?
3. What tools are needed for a gluing job?
4. What precautions should be taken against chilling animal glue?
5. Surplus glue should be removed with a before it becomes
6. Compare animal glue and casein glue on the following points: time for setting, temperature, and consistency.

101. **Gluing Two or More Boards Edge to Edge.** A joint formed between two wood surfaces, which are not cut or shaped so that one fits into the other, is called a "butt joint." Glued butt joints are

stronger and more permanent than either nailed or screwed butt joints. Glued butt joints can only be made between two edges, two sides, or an edge and a side. Glue does not hold well on end wood, because it is absorbed by the open cells. End-wood butt joints therefore cannot be made with glue only, but must be reinforced with nails, screws, or dowels.

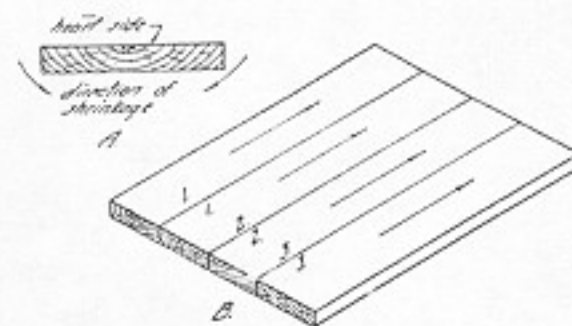


Fig. 267. Boards numbered for gluing. Arrows indicate the direction of the grain.

1. Two bar clamps are placed in wooden blocks on a gluing bench. The boards are laid on these clamps and are so marked that they can be quickly placed in the same position (Fig. 267; Planing Operation 37). The clamps are adjusted so that they open a little more than the combined width of the two boards.

2. Glue is applied simultaneously to the edges by holding the faces of the boards together so that the edges are in a horizontal position. The work must be done rapidly to prevent chilling the glue (Fig. 268).

3. The boards are laid flat on the two clamps. The third one is put

in the middle and on top, and is tightened rapidly. Then the two clamps under the boards are tightened (Fig. 269).

4. The surfaces of the boards are brought to the same level by striking a block of wood, held near the glue joint, with a mallet.

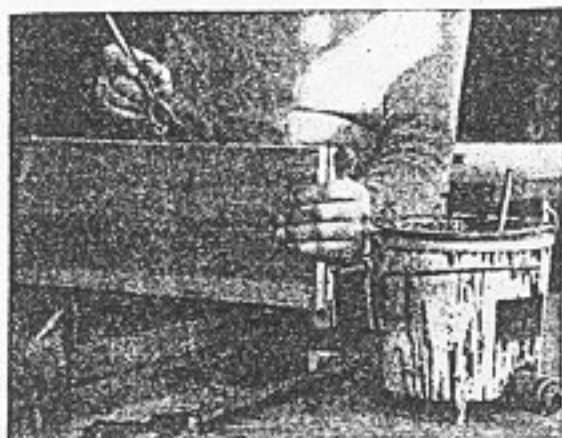


Fig. 268. Applying glue simultaneously to the edges.

5. The boards are tested for flatness with a framing square (Fig. 270). If they bulge in the center, they are clamped with a hand screw to the iron clamps. If this does not correct the trouble, the straight edge of a board or plank, at least 3 in. wide, is clamped across each

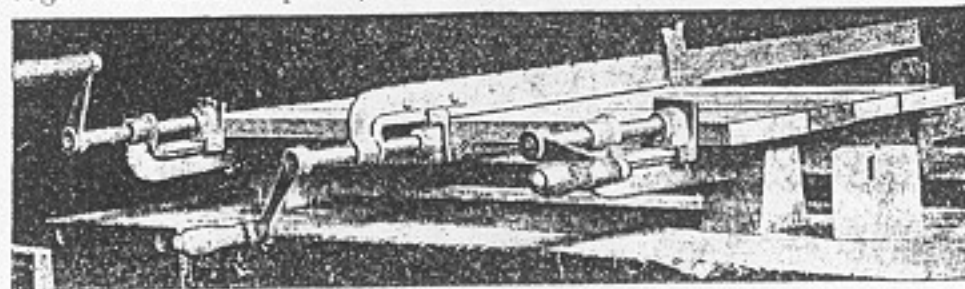


Fig. 269. Gluing boards edge to edge.

end of the boards (Fig. 271). If the boards are long, or if two or more boards are glued at the same time, it may be necessary also to clamp one or more pieces across them in the center. When gluing boards more than 3 ft. in length, three clamps are used below and two above.

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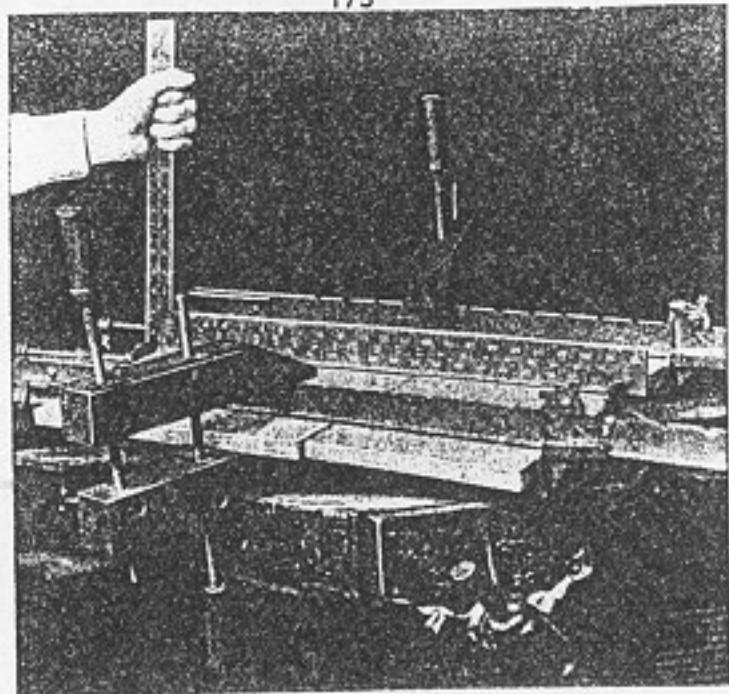


Fig. 270. Testing glued boards for flatness.

QUESTIONS

1. How many clamps should be used when gluing boards 24 in. long, edge to edge?
2. Why are the clamps not all placed on the same side of the boards?
3. What is understood by a butt joint?

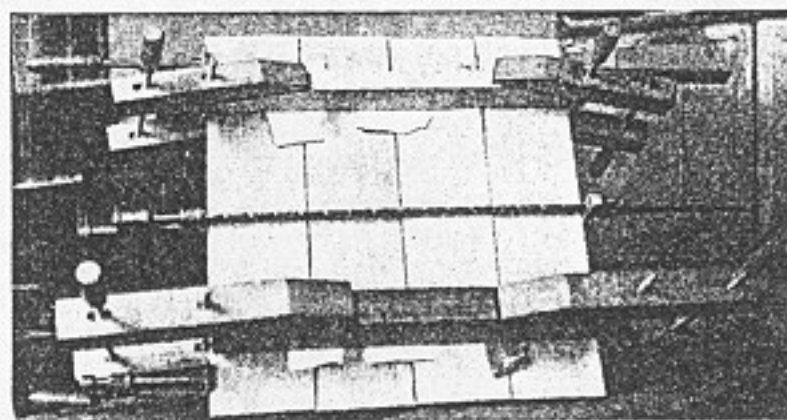


Fig. 271. Planks clamped across glued-up table top to make it flat.

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4. How are the boards held while the glue is applied?
5. Which clamp is first tightened?
6. How are boards, glued edge to edge, kept flat while drying?
7. What is the advantage of placing the lower clamps in blocks?

102. **Gluing Shelf Construction.** Bookcases, bookracks, china and curio cabinets, hanging wall shelves, and other forms of shelving are usually joined with dado or gain joints (see Grooved Joints, Arts. 69 and 70).

1. To glue up a bookcase, for example, blocks are prepared about 2 in. square and as long as the sides of the bookcases are wide. Two blocks are made for each shelf. One side of each block is planed so that the sides of the bookcase will not be marred.

2. The ends of the shelves and the corresponding gains or dados are numbered. The upper or under surface of each shelf also is marked. Two bar clamps adjusted to the right opening for each shelf are made ready to be used.

3. The sides are placed on the gluing bench, and the helper brushes glue into the dados or gains with a $\frac{1}{2}$ -in. round glue brush. Both the bottoms and sides of the joints must be covered with glue. If gain joints are used, glue also is spread on that part of the sides against which the shelves butt.

4. Glue is spread on both ends of the shelves while holding them over the glue pot so that the surplus glue runs back into the pot. As soon as the ends of each shelf have been covered with glue, the shelf is placed into its corresponding dado or gain in one of the sides—for example, the left side.

5. The right side is placed on top of the shelf ends so that each shelf enters its corresponding groove. The joints are driven together with a mallet, and the upper side is protected from being marred by its blows by placing a piece of soft wood over the joints.

6. The bookcase is lifted down from the gluing bench and is placed upright on the floor. The 2 by 2-in. blocks are placed across the sides over each joint and the clamps are tightened up. The planed side of the blocks should bear against the sides of the bookcase. The tendency of the sides is to bulge in the middle when the clamps are applied, therefore thick blocks are needed to keep them flat.

7. A try-square is used to test for squareness. If the shelves and sides are not at right angles to each other, the clamps are loosened and placed obliquely until this defect is corrected (Fig. 272).

8. All surplus glue is cleaned off around each joint with a chisel or glue scraper. The bookcase must dry at least six hours before the clamps are removed.

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QUESTIONS

1. What joints are usually employed in the construction of shelving?
2. How are gain joints glued?
3. Why are thick blocks used across the sides when clamping up a bookcase?
4. Why should one surface of these blocks be planed?
5. How can the sides and shelves of a bookcase be clamped so they are square to each

other?

103. Gluing Square or Rectangular Structures. Square or rectangular structures, such as stools, benches, tables, chests, cabinets, and the like, usually are joined with dowels or mortise-and-tenon joints. They have, as a rule, two ends or sides exactly alike. These are joined together by the front and rear members of the construction.

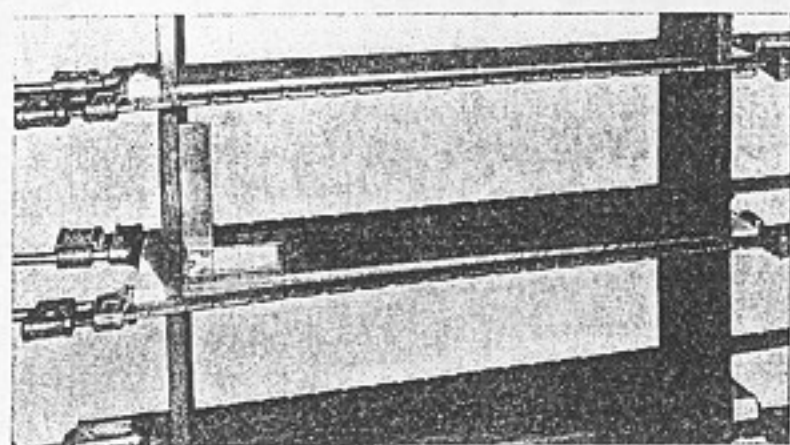


Fig. 272. Squaring bookcase by placing the clamps obliquely.

1. The two end pieces are clamped together without glue in order to thoroughly check measurements and fit of the various members. They are numbered and placed conveniently on the gluing table together with clamps and gluing blocks.

2. Glue is applied to the members of one end and they are then clamped together. They are checked for squareness, and the surplus glue is cleaned off. The second end is glued up in the same manner. If dowels are used, glue is applied to the dowels and to the holes (Dowel Joints, Art. 82, steps 8 to 10). If mortise-and-tenon joints are used, glue is applied both to the mortises and the tenons (Mortise-and-Tenon Joints, Art. 97, steps 5 and 6).

3. The two ends are placed with their inside faces together, they are clamped with hand screws, and then are set away to dry for at

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least six hours. Clamping the ends tightly together in this way corrects any twisting of legs and rails, and insures perfectly square joints when the cabinet or stool is finally assembled (Fig. 273).

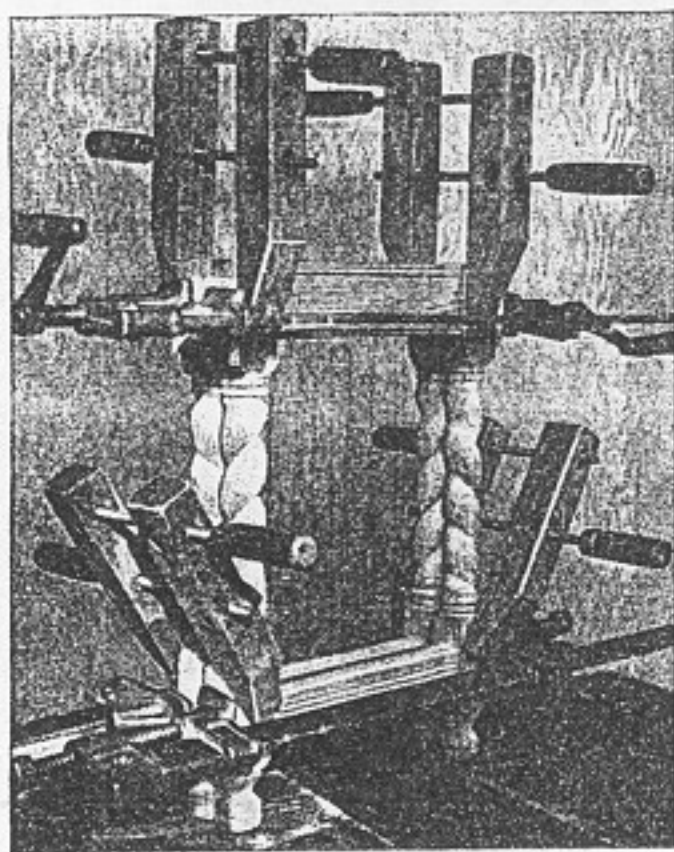


Fig. 273. Two ends of a stool glued and clamped with bar clamps. The ends are clamped face to face with hand screws to prevent the legs from being twisted out of square.

4. The two ends are cleaned off and finished with a plane, a scraper,

and sandpaper, and then the whole structure is glued together. Squareness is checked with a try-square or a steel square and by measuring the diagonals (Fig. 274).

5. When curved surfaces are to be clamped, special gluing blocks must be made to fit over the curves so that the pressure of the clamps will draw up the joint tightly (Fig. 275).

For gluing Dowel Joints see Article 82, page 134.

For gluing Miter Joints see Articles 89 and 90, page 146.

For gluing Paneled Structures see Article 97, page 165.

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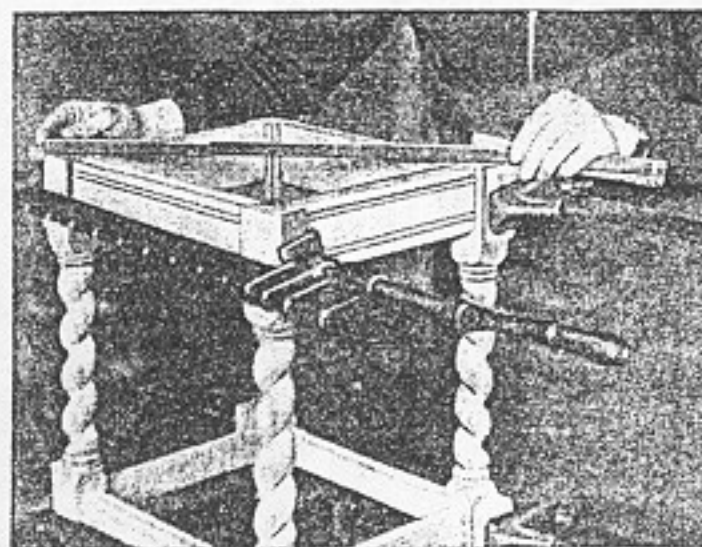


Fig. 274. Testing for squareness by measuring diagonals.

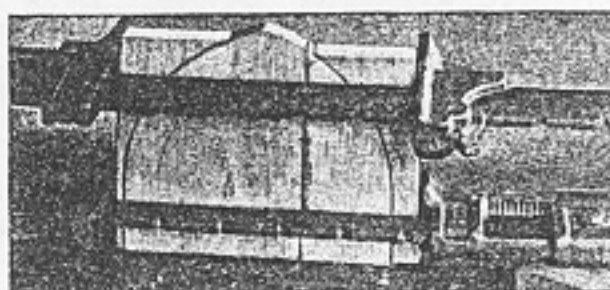


Fig. 275. Gluing up curved work. Special gluing blocks made to fit curves.

QUESTIONS

1. Why is it preferable first to glue up two ends of a rectangular structure?
2. Why should these ends be planed and sanded before the whole structure is assembled?
3. What methods are commonly used for testing a rectangular structure for squareness?

4. Why are the diagonals of a rectangular structure measured?
5. How are clamps and hand screws applied to curved surfaces?

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Chapter XIV

METAL FASTENINGS

105. Information about Nails.
106. Rules for Driving Nails.
107. Information about Wood Screws.
108. Rules for Applying Screws.
109. Information about Bolts.
110. Fastening Hinges.
111. Information about Locks.
112. Attaching Locks.
113. Information about Catches and Door Bolts.
114. Attaching Furniture Handles and Knobs.
115. Fastening a Table Top.

Chapter XIV

METAL FASTENINGS

Although very often several pieces of wood are held together with glue, various types of metal fastenings are used to a great extent. The most important of these are nails, screws, bolts, hinges, catches, locks, and metal plates.

105. Information about Nails. The simplest and quickest way of fastening two pieces of wood together is by using nails. Nailed joints are not as neat, strong, or permanent as glued joints, but they are used

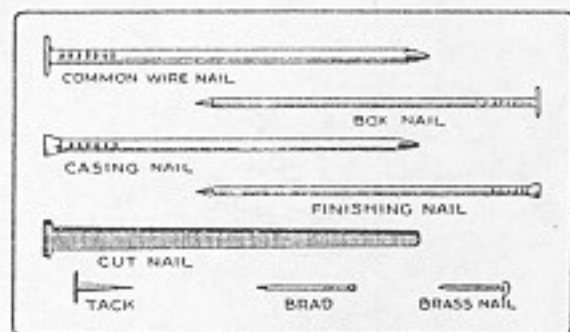


Fig. 278. Nails.

a great deal on rough or inexpensive work, such as house framing and the making of packing boxes, crates, or other wood construction where a finished surface is of minor importance.

1. Nails are used for numerous purposes and are therefore manufactured in many different shapes and of different materials. The most common are those made from steel wire, iron, and brass.

2. Wire nails are made either with a large, flat head or with a very small head. The former are called common wire nails, box nails, etc., and the latter are called casing nails, brads, or finishing nails (Fig. 278).

3. The length of common wire nails is usually indicated by the old English penny system, or inches. Each length of nail is made from a standard thickness of wire. The word *penny* as applied to nails stands for "pound" and refers to the weight of 1,000 nails. Therefore nails weighing six pounds per thousand are called sixpenny (pound) nails,

those weighing ten pounds per thousand, tenpenny nails, and so on. The relation of length to the penny system is as follows:

2-penny nail is 1 in. long	8-penny nail is 2½ in. long
3-penny nail is 1¼ in. long	9-penny nail is 2¾ in. long
4-penny nail is 1½ in. long	10-penny nail is 3 in. long
5-penny nail is 1¾ in. long	12-penny nail is 3¼ in. long
6-penny nail is 2 in. long	16-penny nail is 3½ in. long
7-penny nail is 2¼ in. long	20-penny nail is 4 in. long

4. Common wire nails are sold by the 100-lb. keg and are used mostly in carpentry and heavy frame construction.

5. Box nails are like common wire nails, but a little thinner. They may be obtained plain, barbed, or coated with rosin or cement. Coated nails are very difficult to pull out, and therefore hold much better than common wire nails.

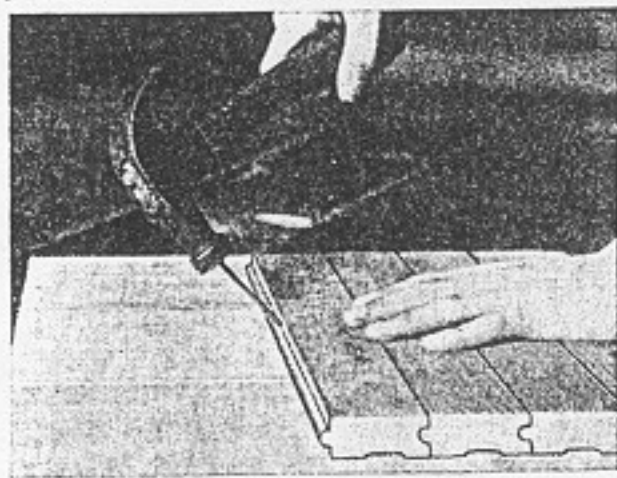


Fig. 279. Nailing flooring.

6. The length of brads or finishing nails usually is given in inches. Brads of the same length may be obtained in several different thicknesses. The diameter of the wire is called its gauge and is indicated by a number; for example, ¾ in. by 18 or ¾ in. by 12. *The higher the number the smaller the diameter of the wire*, or in other words, the thinner the brad. An 18-gauge nail is about 1/20 in. thick; a 12-gauge nail is about 1/10 in. thick.

7. Brads are made in lengths of from ¾ to 3 in., and are sold in 1-lb. cardboard boxes labeled as to the length and gauge. They are used on interior trim, store fixtures, built-in furniture, and many other forms

of woodwork. Casing nails are like brads, but of the same gauge as box nails.

8. Iron nails are cut from a wedge-shaped iron plate and are, there-

fore, called cut nails. They have a blunt end and a very small head. They are used especially in nailing flooring, because they have a rough surface and therefore hold well.

9. Carpet tacks or upholsterers' tacks are also made of iron. They have a very sharp point and a large head. They are made in lengths of from 3/16 to 18/16 in., and are sold in 1-lb. or ¼-lb. cardboard boxes.

10. Brass nails have a small round head. They are from ¼ to 1½ in. in length and can be obtained in various thicknesses. They are used for fastening escutcheons, and in upholstery and boat-building work.

11. Shingle nails, plaster-board nails, and felt-roofing nails are short nails with very large heads.

QUESTIONS

1. For what types of construction are nails preferable to glue?
2. What kind of nails are used for nailing flooring? Why?
3. The most common types of nails are
4. What is understood by the "penny system"?
5. What is understood by the gauge of a wire?
6. Which brad is the thickest, 1 in. by 16 or 1 in. by 18?

106. Rules for Driving Nails. The hammer used by woodworkers is called the claw hammer, because its peen is shaped like a claw, which



Fig. 280. Driving a nail back with a nail set placed over its point.

can be used for pulling nails. The face of the hammer is often slightly rounded (bell-faced), so that it will not make a circular mark on the surface of the wood after striking the last blow on a nail. The size of the hammer is indicated by the weight of its head in pounds and ounces.

1. Several nails should not be driven close together in a line following the grain. They should be staggered, because the nails will act as a series of small wedges and split the wood.

2. In general, nails should be driven as straight as possible, but in

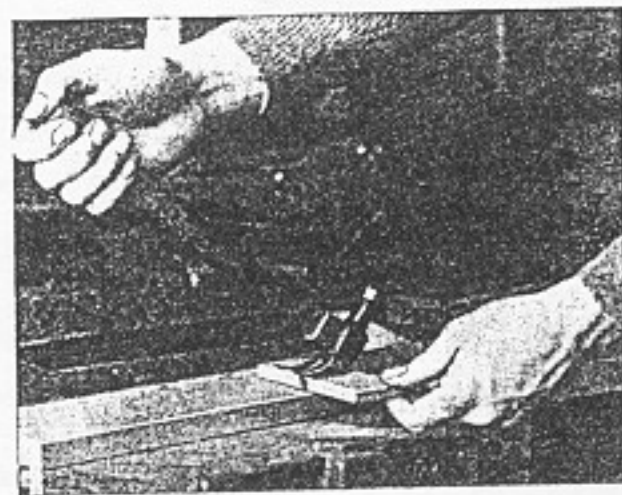


Fig. 281. Pulling nail with claw hammer. Block placed under hammer head to protect the surface of the wood.

some cases, as in toenailing (Fig. 285) and in nailing floors (Fig. 279), nails are driven at an angle.

3. When driving a nail, it is held with the fingers of the left hand until its point is firmly imbedded in the wood. If the nail is slightly inclined toward the worker, it is easier to hit it right on the head at every blow of the hammer. The hammer should not be held close to the head but near the end of the handle.

4. Glue, grease, or dirt on the hammer head causes it to glance off when striking the nail. The face of the hammer should be cleaned by rubbing it on a piece of fine sandpaper.

5. If a fine nail bends, it should not be straightened, but pulled out, and another driven in the same hole.

6. If a nail is driven so that its point comes out on either side of the work, it should be pulled out, but another nail should not be driven in the same hole, because it will follow the passage made by the first

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one. A nail has a tendency to follow the grain of the wood. This often may be counteracted by blunting its point with a hammer.

7. When the point of a nail, which is driven home, comes outside the surface, it is driven back with a nail set (Fig. 280) until the head

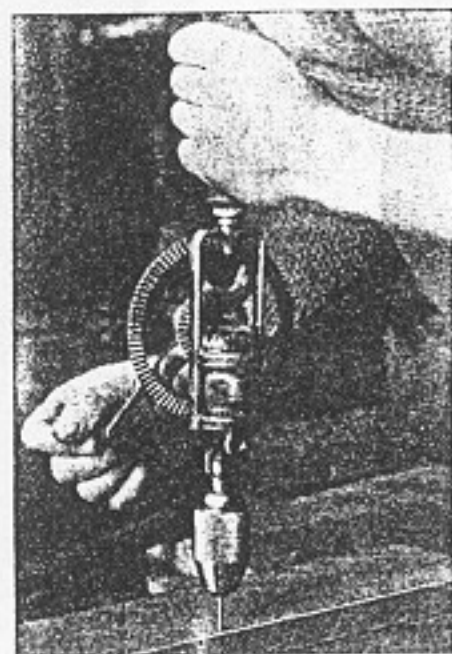


Fig. 282. Boring hole in hard wood with a nail.

projects enough above the surface to be pulled out with a claw hammer. A nail set is a short steel rod with a cupshaped end, which keeps it from sliding off the head of nails. A block of wood placed under the head of the hammer protects the surface from being marred and gives more leverage to the hammer (Fig. 281).

8. In hard woods it is well to bore a hole for a nail, using a bradawl or a hand drill. The head of the nail is cut off, and it is used in the hand drill instead of a fine drill point (Fig. 282).

9. Finishing nails are set below the surface with a nail set and a hammer (Fig. 283). Nails with large heads usually are not set below the surface.

10. When nails penetrate through both pieces of wood, their points are bent over or "clinched" (Fig.



Fig. 283. Setting nail below surface.

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it is hammered down until it crushes the fibers. Its point cannot always be completely imbedded in the wood. Clinching is best done on an iron surface.

11. When the end of one piece is nailed to the side of another and the nails are driven obliquely, the piece is said to be "toenailed" (Fig. 285).

12. Nailed joints often are reinforced with glue. When animal glue is used, the nails are driven partly through the first piece, and one or two of them partly into the second piece, so that the position of the two pieces can be quickly located after the glue is applied. The nailing must be done as rapidly as possible, because animal glue thickens when it cools. Chilled glue does not produce a tight, strong joint.

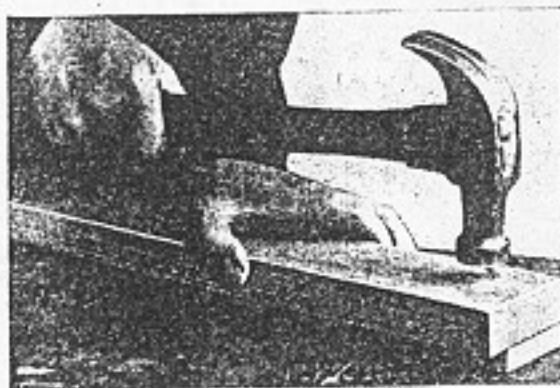


Fig. 284. Clinching a nail.

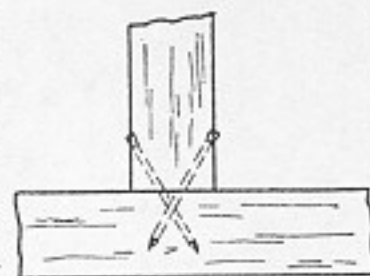


Fig. 285. Toenailing.

QUESTIONS

1. What do the following terms mean when applied to a hammer: peen, ounce, bell-faced?
2. Why is wood likely to split when nails are driven close together in a line following the grain?
3. Why should a hammer be held near the end of the handle rather than near the head?
4. What is the probable cause when you cannot hit the nail squarely?
5. How may a nail "driven crooked" be removed without marring the wood?
6. How can a thin nail be driven into hard wood without bending?
7. How should a nail be "clinched"?
8. What precautions must be taken when animal glue is used to re-enforce a nailed joint?

107. Information about Wood Screws. Screws hold better than nails, but are more expensive and require more care and effort to insert. Work put together with screws can be taken apart without splitting or marring the pieces.

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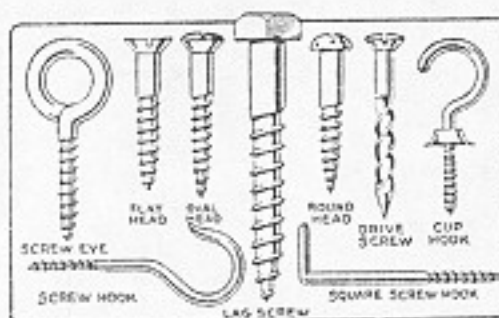


Fig. 286. Screws.

1. Screws used for wood are classified according to the shape of their heads, as flat head, round head, and oval head, and according to the material of which they are made (Fig. 286).

2. Their size is given both as to length in inches and diameter of the smooth part of the screw just below the head (wire gauge).

3. Wood screws are made in lengths of from $\frac{1}{4}$ to 5 in. The diameter or wire gauge is indicated by a number running from 0 to 24. The higher the number the greater the diameter of the screw. No. 5, for example, is $\frac{3}{8}$ in. thick, and No. 14 is $\frac{1}{4}$ in. thick. The wire gauge of screws most commonly used runs from No. 5 to No. 12.

4. Screws are made of soft steel, commonly called iron screws, and of brass. The flat-head iron screws are usually bright, while the round-head screws are blued. Iron screws are also nickel or brass plated. Screws are sold by the gross and put up in cardboard boxes. Their length and diameter (wire gauge) are marked on the box, as for example $1\frac{1}{4}$ in. by 9.

5. Lag screws (Fig. 286) have a square head like a bolt, and are driven in place with a wrench instead of a screw driver. They are made in diameters from $\frac{1}{4}$ to 1 in., and in lengths from 1 to 16 in. They are used in heavy timber construction.

6. Screw hooks, cup hooks, and screw eyes (Fig. 286) are made of steel, brass, and galvanized iron, and are obtainable in many different sizes. They are inserted in wood like ordinary screws, and are used as supports for keys, kitchen utensils, curtains, pictures, mirrors, and many other objects. Small screw eyes are inserted in the backs of picture frames for holding the picture wire which is twisted around them.

7. Drive screws are half nail and half screw. They are driven into the wood like a nail, but hold better because they are threaded.

QUESTIONS

1. How are wood screws classified?
2. How does the wire gauge of wood screws differ from that of nails?
3. What are the advantages and disadvantages of using screws instead of nails?

108. Rules for Applying Screws. 1. When two pieces of wood are

to be fastened together with screws, two holes of different diameters must be bored. The first hole should be equal to the diameter of the

smooth part of the screw, called the shank, so that it can be pushed into the hole with the fingers. The second hole should be equal to the root diameter of the thread so that the screw, when driven in, cuts its own thread in the wood. A screw thread is a groove cut around a metal rod. The deepest part of this groove or thread is called its root. The root diameter therefore is the diameter of the rod less the thread. In

Gauge No. of Screw	4	5	6	7	8	9	10	11	12
Dia. of First Hole	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{5}{32}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{3}{16}$	$\frac{7}{32}$	$\frac{7}{32}$
Dia. of Second Hole	$\frac{3}{32}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{5}{32}$	$\frac{5}{32}$	$\frac{5}{32}$	$\frac{5}{32}$	$\frac{5}{32}$

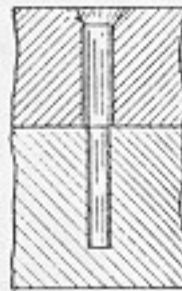


Fig. 287. Table showing size of holes in inches to be bored for screws of various gauges.

hard woods, the second hole should be bored as deeply as the screw enters into the wood; in soft woods it may be omitted or bored about half this distance (Fig. 287).

2. Twist bits, twist drills, gimlet bits, fluted drills, and bradawls are used for boring holes for screws (Boring Operations 61, 62, 63, and 64).

When flat-head or oval-head screws are used, the upper end of the first hole is widened with a countersink (Boring Operation 65) to make room for the head of the screw.

3. A screw driver or a screw-driver bit and brace is used for driving or turning the screw into the wood (Figs. 288 and 290). The end of the screw driver should fit the slot in the screw snugly and should be of the same width as the head of the screw. It is extremely important that the sides and end of the screw driver are flat (Fig. 289). A screw driver with rounded or beveled sides will climb out of the slot of the screw and damage it so that the screw cannot be turned. A worn screw driver is ground on an emery wheel.

4. Soap or wax is used as a lubricant when driving screws. This reduces friction and therefore the danger of "twisting off" or breaking of the screws. Screws generally twist off where the thread begins and when that part of the screw is below the surface. It is almost impossible to remove the part of a screw imbedded in the wood without seriously damaging the wood around it.

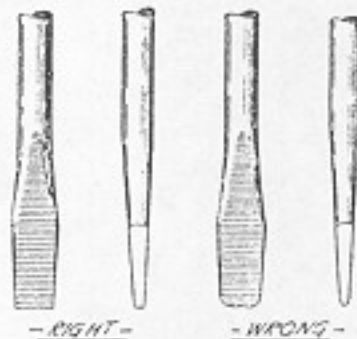


Fig. 289. Right and wrong shapes of the end of a screw driver.

5. Brass screws twist off more easily than iron screws. To avoid this, an iron screw of the same size is driven first. The iron screw is removed

and the brass screw inserted, which now enters easily. Brass screws are used mostly for fastening hardware to wood.

6. Screws sometimes are set below the surface of the wood, after which the hole is plugged with a wooden plug. Such plugs can be cut with a tool called a plug cutter, the end of which fits into a brace. Plug cutters are made to cut plugs of different diameters, as $\frac{1}{2}$, $\frac{9}{16}$, and $\frac{5}{8}$ in. (Fig. 291).



Fig. 291. Plug cutter.

7. A hole is bored with an auger bit of the same diameter as the plug cutter and at least $\frac{3}{8}$ in. deep. Then the hole for the screw is bored as explained in the foregoing. Plugs are cut from the same kind of wood as that in which they are to be inserted.

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8. The screw is inserted, a plug is selected that matches the grain of the surface as nearly as possible, and it is glued in place, being driven tight with a hammer.

9. When dry, the plug is planed level with the surface. Plugs with rounded heads may be obtained at hardware stores (Fig. 292).

10. Screws do not hold well in end wood, because they run in the same direction as the wood fibers. It is therefore best to avoid this type of butt joint unless a dowel is glued into the wood near the end. Driving the screws through this dowel strengthens the joint considerably (Fig. 292).

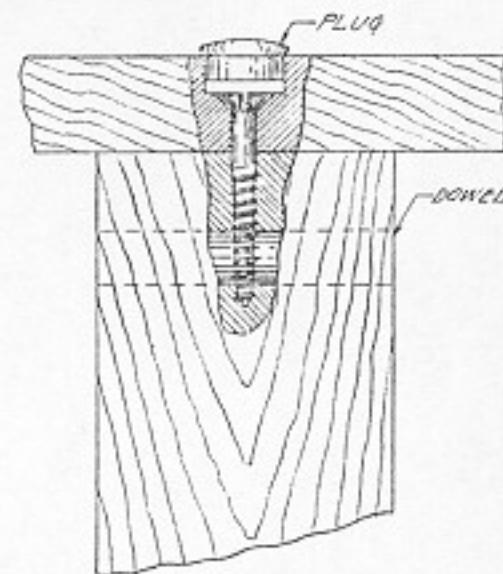


Fig. 292. Screw in end wood passing through dowel. Screw set below surface and hole plugged.

QUESTIONS

1. What is understood by the root diameter of a screw?
2. How could you judge the size and efficiency of a screw driver for a given job?
3. How may a screw be concealed below the surface of the wood?
4. What can be done to make a screw hold better in end wood?

109. Information about Bolts. 1. Bolts differ from screws in that they do not taper to a point but have the same diameter from head to end (Fig. 293). A square or hexagonal piece of iron or steel, called a nut, is screwed on the threaded end of a bolt. Winged

nuts, which can be screwed off or on by hand, may be used when no great pressure is needed. The threads on a bolt are very different from those on a wood screw.

2. Bolts are used in woodwork where great strength is required (see draw-bolt joint, Art. 85) or where wood is fastened to metal or masonry. When used in wood a hole of the same diameter as the bolt is bored through the

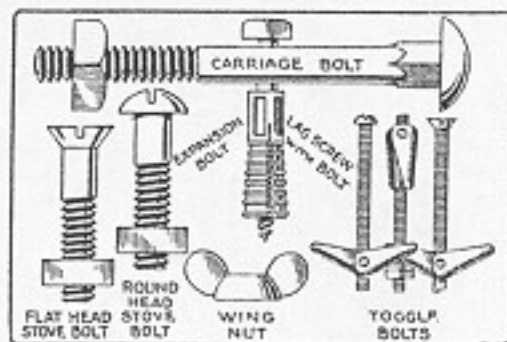


Fig. 293. Bolts.

pieces it is to hold together. A washer, which is a round piece of iron with a hole in the center, is placed between the head of the bolt and the wood and another between the nut and the wood. When the bolt is tightened, these washers distribute the pressure of the bolt over a larger area and thereby prevent the head and the nut from digging into the wood.

3. The most common bolts are stove bolts, carriage bolts, expansion bolts, toggle bolts, and machine bolts.

4. Stove bolts are small and cheaply made, from $\frac{3}{8}$ to 6 in. long, and from $\frac{1}{8}$ to $\frac{1}{2}$ in. in diameter. Like wood screws, they have flat or round heads slotted for a screw driver.

5. Carriage bolts are made especially for wood. They have a rounded head, which cannot be turned by wrench or screw driver. A square section just below the head prevents them from turning in the hole when they are driven home. Carriage bolts are from 1 to 12 in. long and from $\frac{3}{16}$ to $\frac{1}{4}$ in. in diameter.

6. An expansion bolt consists of a two-part iron shield and a lag screw. When timber or machinery is to be fastened to concrete or brick, a hole must be drilled for the shield. When the lag screw is driven into the shield, which is threaded on the inside, the two halves expand and the work can be drawn up tightly and securely.

7. Toggle bolts are stove bolts which have a special nut made of bent pieces of sheet iron, hinged together and spread apart by means of springs. The parts of the nut can be folded around the bolt while it is inserted through the hole made for it. Toggle bolts are used to fasten wood or metal to hollow tile walls.

8. Machine bolts are accurately made and furnished both in small and large sizes. They have square or hexagonal heads or nuts. Machine screws are like machine bolts, but have no nuts. They are used only in metal.

QUESTIONS

1. What is the difference between a lag screw and a bolt?
2. What is an expansion bolt? What is a toggle bolt?
3. What is the difference between a stove bolt and a machine bolt?
4. How does a carriage bolt differ from other bolts?

110. Fastening Hinges. The easiest way to make a movable joint between two pieces of wood is by means of a hinge. Hinges are made in different forms and of different materials, such as brass, iron, galvanized iron, nickel, and brass-plated iron. The most common hinge is the butt hinge, which consists of two rectangular leaves bent around and held together with a steel pin. If the pin can be removed, the hinge is called a "loose-pin" hinge (Fig. 294). If it is riveted together with the

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leaves, it is called a "fast-joint" hinge (Fig. 295). The size of hinges is given according to the length and width of the leaves. Other common types of cabinet hinges are desk hinges (Fig. 296), continuous hinges, double-acting or screen hinges, box and chest hinges, surface hinges, and invisible hinges (Fig. 297). Common types of hinges used in carpentry are the cupboard hinge, the strap hinge, the T hinge, the spring hinge, and hinge hasps (Fig. 297).

1. A hinge usually is set flush or a little below the wood surface. In the latter case a groove or recess must be cut in the wood. Such a groove is called a "gain."

2. When hinging a paneled door, the hinges are placed so that the

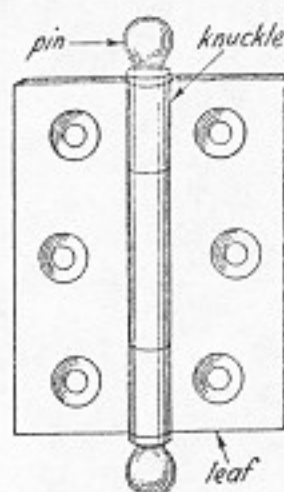


Fig. 294. Butt hinge with loose pin.

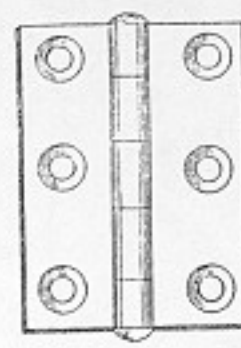


Fig. 295. Fast-joint butt hinge.



Fig. 296. Desk hinge.

upper one is just below the upper rail and the lower one just above the lower rail (Fig. 298). When hinging the lid of a box or chest, the hinges are placed so that the distance from the hinge to the edge of the box is equal to the length of the hinge.

3. The position of the hinges is determined by placing the lid in position on the box and marking the length of the leaves on both pieces. Lines are squared across at these points.

4. When hinging a door, the first consideration is to fit the door to the frame. First, the edge to which the hinges are to be attached is planed. Then the top of the door is squared to this edge. If it is a large paneled door, the ends of the stiles (the horns), which project over the top rail of the door, are sawed off flush with its upper edge.

5. The next step is to plane the door to width, and finally to saw

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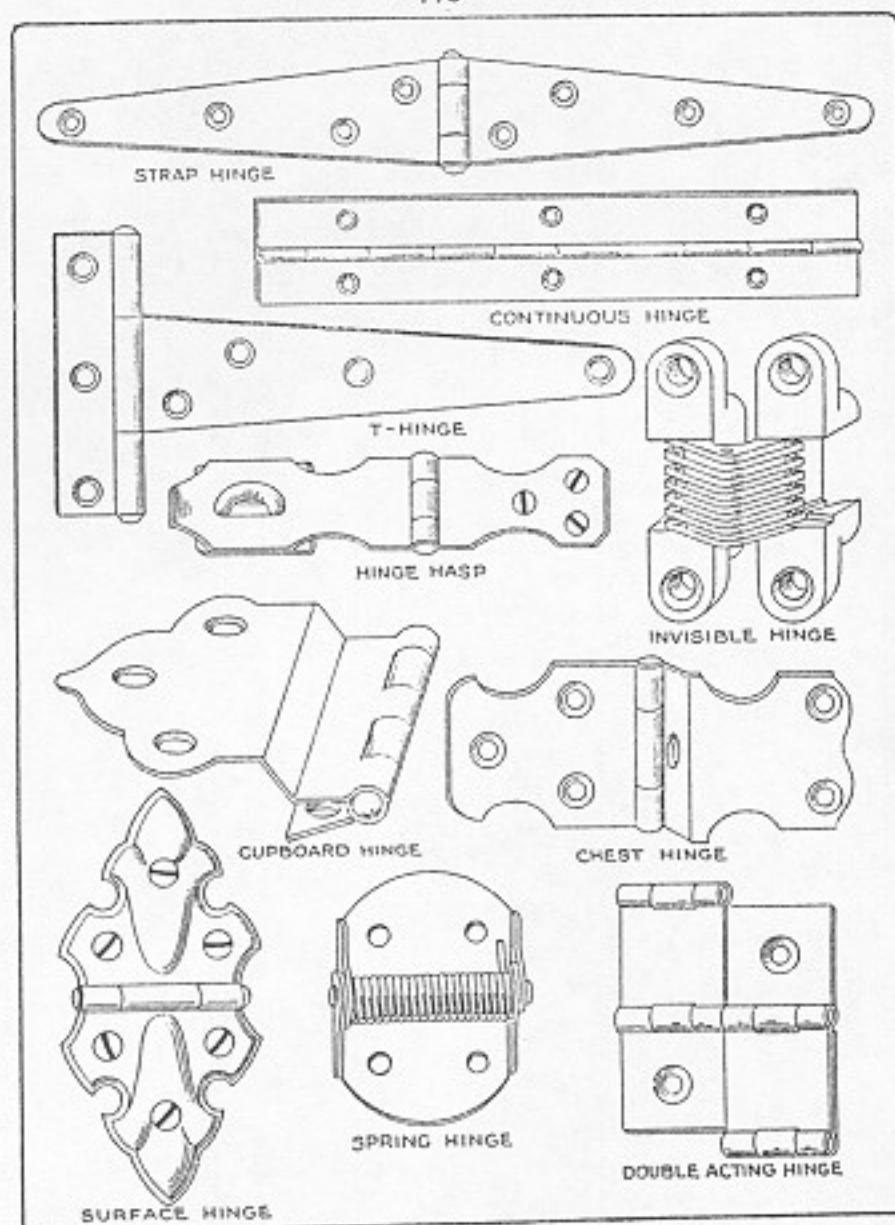


Fig. 297. Hinges.

and plane the lower edge of the door until it fits in the frame. It is well to make a close fit to begin with, for it is easy to plane off more later if

necessary.

6. The door is placed in its opening, and wedges are driven under it so that its upper edge is pressed firmly against the frame. The position of the hinges on both door and frame is then marked (Fig. 298)

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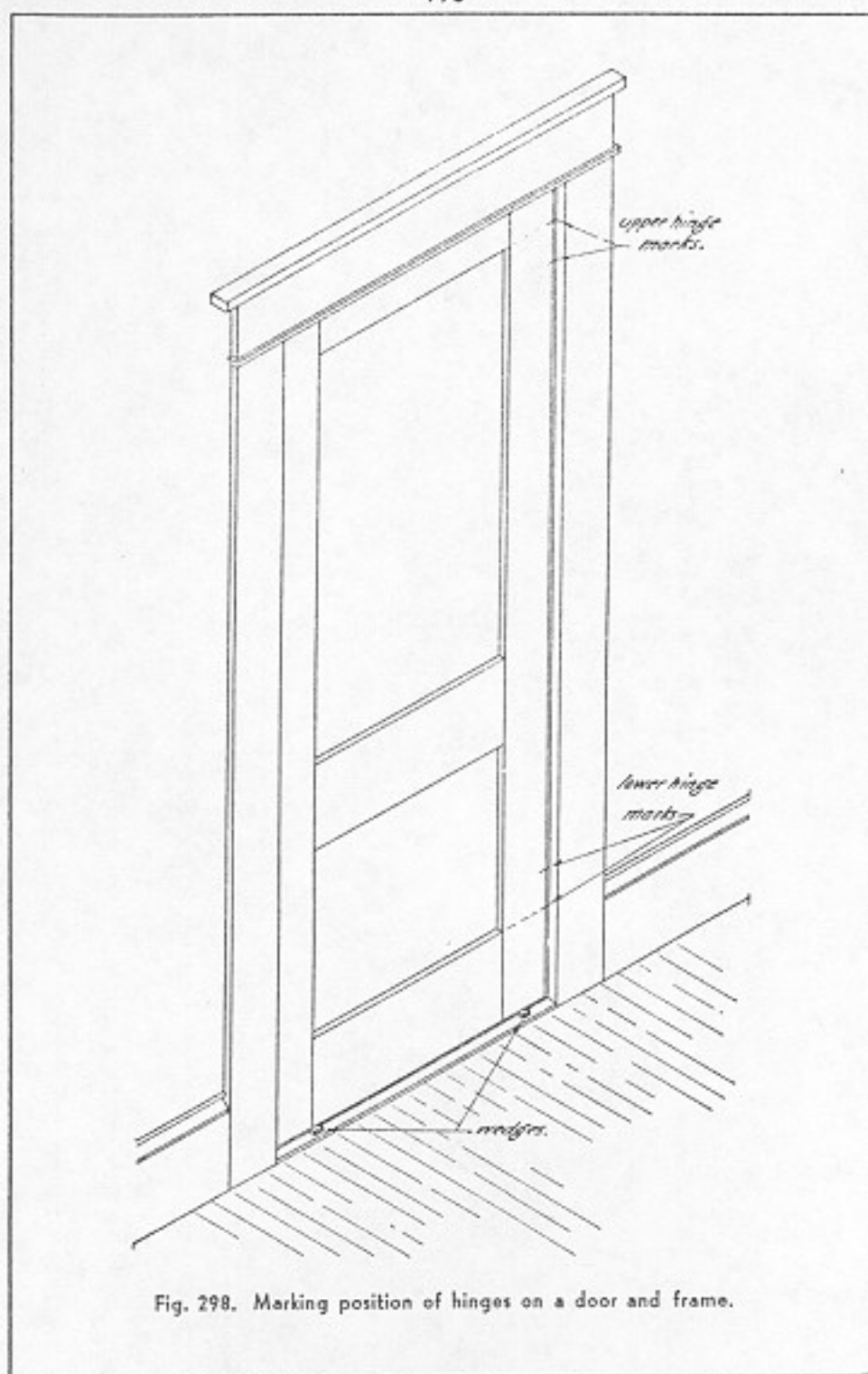


Fig. 298. Marking position of hinges on a door and frame.

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7. A marking gauge is set to the width of the leaves, not including the knuckle, and gauging is done between the lines squared. The knuckle should project outside a door frame to allow the door to swing free of the frame.

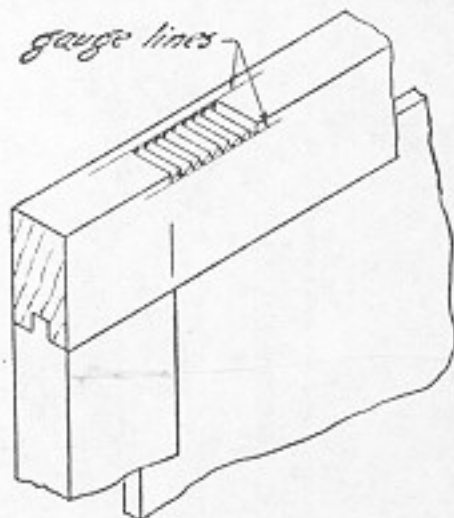


Fig. 299. Chiseling gain on door.

8. The length and width of the gains have now been marked. The depth of the gains for small cabinet hinges is equal to half the thickness of the knuckle. The gains for heavier hinges, such as are used on house doors, are made of the same depth as the thickness of the leaves. The marking gauge is set accordingly, and the depth of the gains is gauged.

9. The outline of the gains is chiseled very carefully, making first a light perpendicular cut around the outline and then a V cut on the inside of the lines marked (Fig. 299).

10. Shallow chisel cuts then are made across the surface of the

gains. Chiseling is done to the depth line by holding the chisel with the flat side down. Chiseling across the grain or obliquely gives the best results. The recesses are finished either with a chisel or a router plane (Fig. 300).

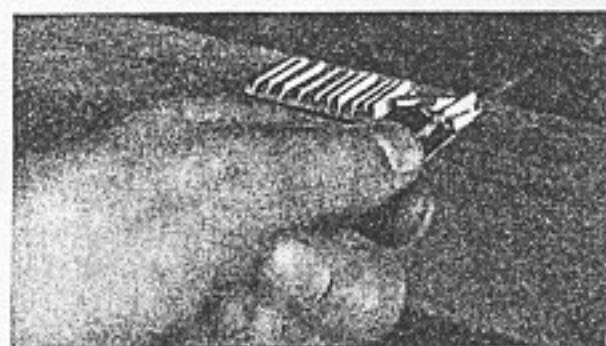


Fig. 300. Chiseling gain for hinge.

11. The hinges are placed in position, and the leaves are bored for screws with a bradawl (Boring Operation 64).

12. A hole is bored for only one screw in each leaf. The screws are inserted, using soap or wax as a lubricant. If brass screws are to be

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used, a steel screw of the same size is driven first (Art. 108, steps 4 and 5). If loose-pin hinges are used on doors, one part of the hinge is screwed to the door and frame respectively, the door is placed in position, and the pins are inserted.

13. If there is an opening between the hinged wood surfaces, the gains are not deep enough. If a door or the lid of a box springs back when an attempt is made to close it, the gains are too deep. Pieces of cardboard or heavy paper are placed below the hinges to bring them up.

14. Continuous hinges can be obtained in any length desired and are used for pianos, boxes, and cabinet doors.

15. The invisible hinge is mortised into the edges of a door and frame so that no metal shows when the door is closed. The shape of the hinge is laid out accurately, and holes of the correct size and depth are bored with a dowel bit. The faces of the hinge are set flush with the surfaces of the wood.

16. Hinges like the surface hinge, the cupboard hinge, the strap hinge, the T hinge, the spring hinge, and the hinge hasp are simply screwed to the surface of the wood without cutting any recess for it. The spring hinge is used on doors, as screen doors, so that they will close automatically. The T hinge and the strap hinge are used on garage doors, gates, cellar doors, tool boxes, etc. The hinge hasp is used on boxes and tool chests which are locked with a padlock.

QUESTIONS

1. What are the principal parts of a butt hinge?
2. What are the rules for locating hinges on a paneled door and on a box or chest?
3. How is the length and width of a butt hinge laid out?
4. What can be done if the gains have been made too deep?

111. Information about Locks. 1. Cabinet locks are used for drawers, doors, boxes, desks, and chests. They are made in many different types and sizes.

2. The main parts of a lock are the bolt, which is an iron bar moved forward or backward with a key, the lock box which contains the tumblers, springs, and other mechanism, the key pin, and the selvage, which is the edge of the lock through which the bolt moves (Fig. 301). Some locks are furnished with a metal plate called the strike. This strike is screwed to the frame opposite the lock, and has an opening through which the bolt enters when in a locked position (Fig. 302).

3. The two most common types of cabinet locks are the mortise lock (Fig. 302), which is completely set into the wood so that the selvage is flush with the surface, and the rim lock which is attached to the rear face and edge of the door or drawer (Fig. 301).

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4. Some rim locks have no selvage (Fig. 304). These are simply screwed to the wood surface, which is not cut because the lock box is on the outside. Others have a selvage (Fig. 301) which must be set flush with the wood. An opening must also be chiseled for the lock box of this type of lock.

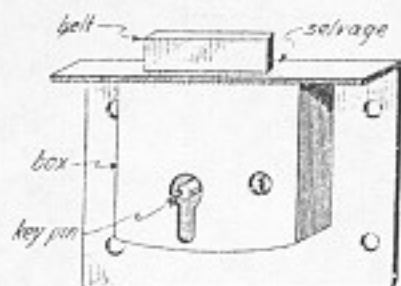


Fig. 301. Rim lock.

5. Keys are mainly of two types, the round or barrel, and the flat key. The barrel key is hollow and fits over the key pin in the lock. Other round keys are solid and fit into locks without key pins. The flat keys are either plain or grooved lengthwise. Some flat keys are cut on both edges (Fig. 303).

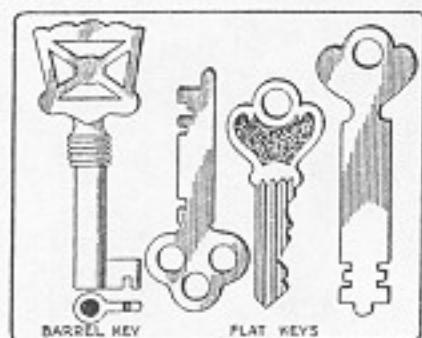


Fig. 303. Keys.

6. Some locks open with the old-fashioned barrel key, others with the modern flat key. The latter kind are called cylinder locks and are of the rim type (Fig. 304).

7. The bolts on door and drawer locks are constructed to withstand a sidewise pressure. The bolts on desk, box, and chest locks, however,

7. The lock is fitted in place, and the cutting of the keyhole is finished with a coping saw or a keyhole saw and a 1/16-in. chisel.

8. The key then is tried while holding the lock in place with the hand. When the key moves the bolt freely, the lock is attached to the wood with four screws.

9. When attaching a mortise lock, the length and thickness of the box are laid out on the edge of the door and drawer so that the key pin will come in the center of the hole bored for it.

10. This mortise is bored and chiseled as explained in Mortise-and-Tenon Joints, Article 92, steps 9 to 14. The lock is inserted, and a line is marked around its selvage.

11. The lock is removed, and the recess for the selvage is chiseled as in step 6.

12. The keyhole is made as in step 7, the key is tried in the lock, and is attached with two screws.

13. To locate the position of the strike, the bolt is projected from the lock, and its edge is covered with paint. The key then is turned so that the bolt is drawn into the lock flush with the selvage. The door or drawer then is closed, and the key is turned as when locking it.

14. Some of the paint on the edge of the bolt now is transferred to the door frame. A hole is chiseled for the bolt at this place. When the bolt enters easily into this hole, the strike is placed in position, its outline is marked, a recess is chiseled for it, and it is screwed in place.

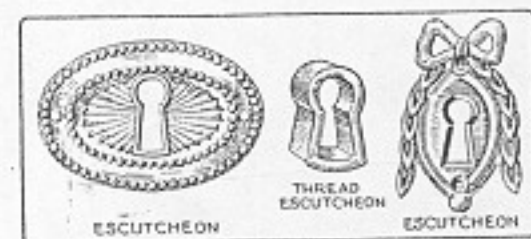


Fig. 307. Escutcheons.

surface around the keyhole from being worn or marred. Some escutcheons, called thread escutcheons, are made to fit inside the keyhole so that only a narrow band of brass marks its outline (Fig. 307).



Fig. 302. Mortise lock with strike for a box.

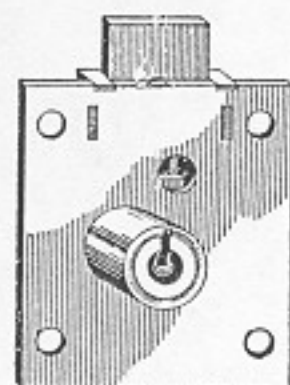


Fig. 304. Cylinder rim lock.

QUESTIONS

1. How is a lock centered on a drawer? on a door?
2. How is the keyhole located?
3. What is the first operation in making a keyhole?
4. What is the first step in locating and attaching a cylinder lock?
5. How can the strike be located?
6. What is the purpose of escutcheons?

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must withstand a direct upward pull. These bolts therefore have hooks of different shape which engage in the strike when in a locked position (Fig. 302).

8. When buying a lock, the first thing to decide is the type most suitable for the work in hand, then the thickness of the wood for which the lock is to be used, and finally the distance from the key pin to the selvage.

QUESTIONS

1. Which are the two most common types of cabinet locks?
2. Why are cylinder locks not of the mortise type?
3. Which type of lock must always have a strike?
4. What information as to type and size must be given when ordering a lock?
5. Can you identify the following parts of a lock: bolt, lock box, selvage, key pin, strike?

112. Attaching Locks. 1. When attaching a lock to a door or drawer, the first consideration is to get the key pin accurately centered.

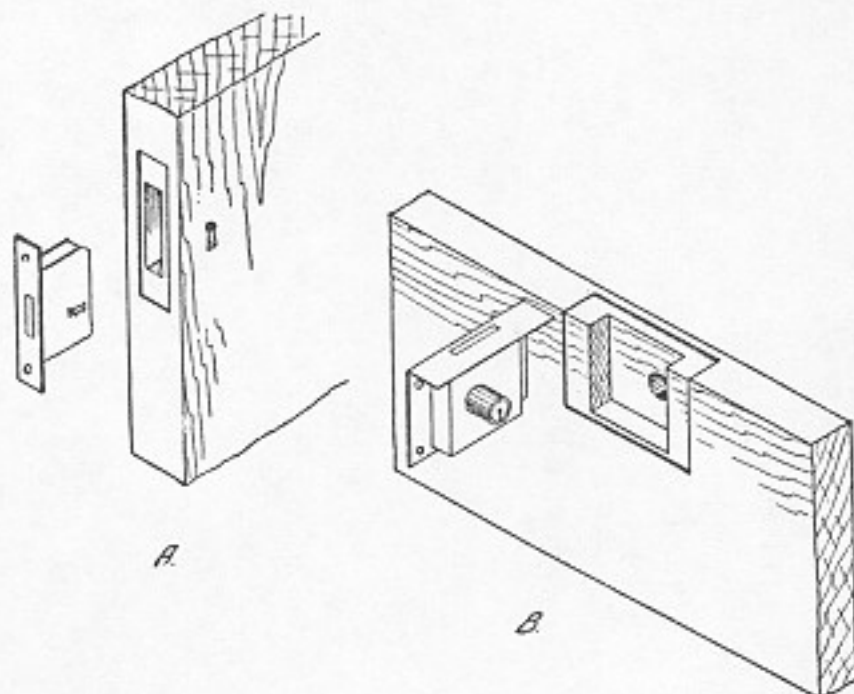


Fig. 305.

A vertical center line is laid out on a drawer and a horizontal center line on a door.

2. The distance from the key pin to the selvage is measured, and

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is laid out from the edge of the door or drawer on the center line marked (Fig. 306).

3. A hole is bored, a little larger than the diameter of the barrel of the key, at this point. This is the first part of the keyhole.

4. If a cylinder lock is to be used, the distance from the center of the cylinder to the selvage of the lock is measured. The diameter of the cylinder is calipered carefully, and a hole is bored of exactly the same diameter, so that the cylinder will fit snugly. It is well first to bore a trial hole in a piece of waste wood.

5. If a rim lock is to be attached, the dimensions of the lock box are marked on the inside surface of the wood around the hole bored for the key pin. Then this recess is chiseled out. *The key pin is not always in the center of the lock box* (Fig. 301).

6. The length and width of the selvage are marked on the edge of the wood, and this recess is chiseled out in the same way that a gain is chiseled for a hinge (Art. 110, steps 6 to 8).

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113. Information about Catches and Door Bolts. 1. Catches and bolts are locking devices which do not require a key. They are used

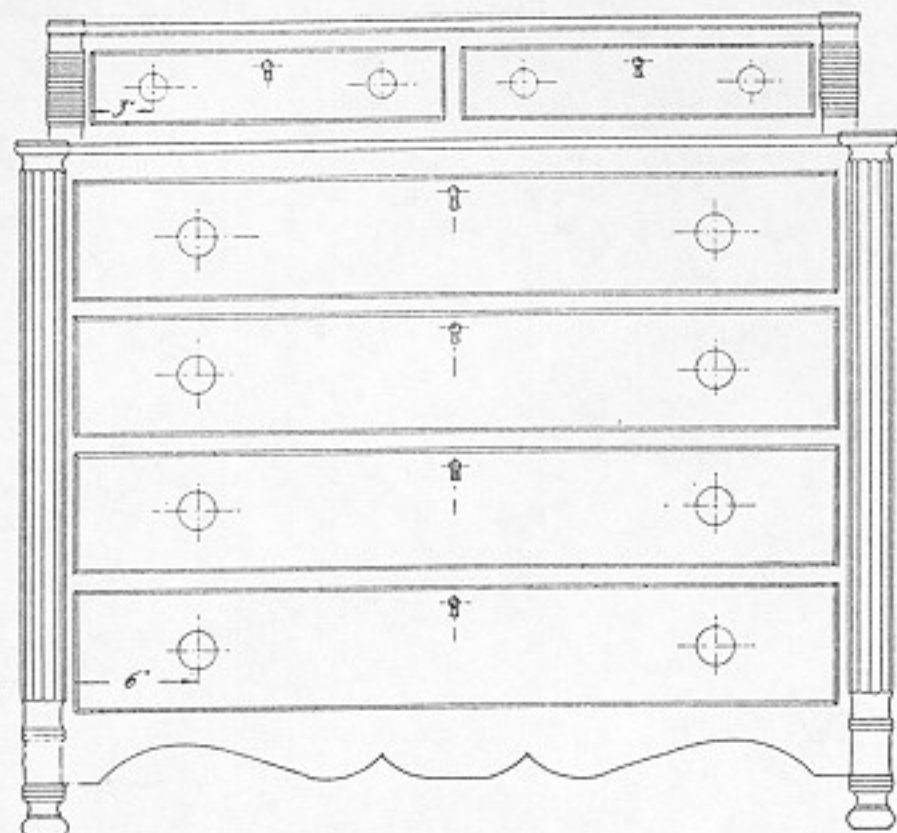


Fig. 306. Locating locks and knobs.

principally on cabinet doors. The most common catches are cupboard catches, elbow catches, and ball catches. The most common door bolts are plain door bolts and flush door bolts.

2. Cupboard catches (Fig. 308) are simply screwed to the outside surfaces of cupboard doors. Elbow catches lock automatically by means

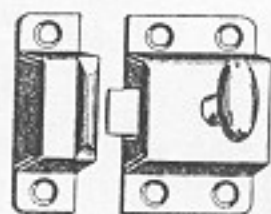


Fig. 308. Cupboard catch.

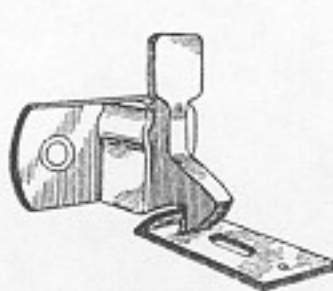


Fig. 309. Elbow catch.

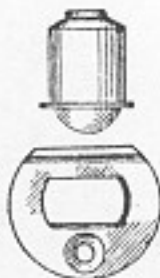


Fig. 310. Ball catch.

of a spring, a hooked lever, and a bent metal plate (Fig. 309). The metal plate is screwed to the underside of a shelf in a cupboard or bookcase. The catch is screwed to the inside surface of the left-hand door so that the hook engages the metal plate.

3. Ball catches consist of a brass cylinder which contains a spring pressing against a steel ball (Fig. 310). They are made in diameters of $\frac{1}{4}$, $\frac{5}{16}$, and $\frac{3}{8}$ in. To attach a ball catch, a hole of the proper size is bored in the end or edge of a small cabinet door. The strike is screwed to the frame opposite the ball, and the beveled side of the strike is placed toward the front.

4. Door bolts are screwed to the inside surface of a left-hand cupboard or bookcase door, so that the bolt will enter the frame when locked (Fig. 311). Some door bolts are furnished with strikes which are set flush with the wood. On small doors only one bolt is used. On larger doors two bolts are used, one at the upper edge and one at the lower edge.

5. A flush bolt is a neater type of door bolt (Fig. 312). It is attached to the edge of a cabinet door and, as its name implies, is set flush with the wood surface.

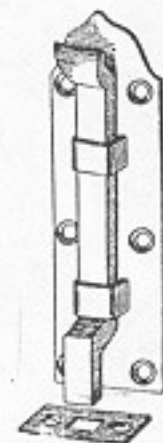


Fig. 311. Door bolt.



Fig. 312. Flush door bolt.

QUESTIONS

1. How is an elbow catch attached?
2. On what kind of door would a ball catch be suitable?

3. What is the difference between flush bolts and door bolts?

114. Attaching Furniture Handles and Knobs. 1. Furniture handles and knobs are made in a great variety of patterns to correspond with the different styles or periods of furniture design. Knobs are made of metal, glass, or wood and are used on drawers and doors (Fig. 313). Handles are made of metal and are used on drawers (Fig. 314). Knobs and handles are usually attached with a machine screw about $\frac{1}{8}$ in. in diameter and 1 in. long (Fig. 313).



Fig. 313. Furniture knob.



Fig. 314. Furniture handle.

2. The position of knobs or handles is located on a chest of drawers by first drawing horizontal center lines on both sides of the drawer fronts. The distance from the sides of the drawers then is measured, usually from 3 to 6 in. on the center lines (Fig. 306). For handles, usually two holes are needed. A knob is placed on a cabinet door on the horizontal center line and quite close to the edge of the door, depending upon the size of the knob as well as that of the door.

3. Holes of the same diameter as the machine screws then are bored at these points. The screws are inserted from the back of the drawer, and are tightened with a screw driver.

QUESTIONS

1. Of what materials are furniture pulls commonly made?
2. How are furniture handles located on a chest of drawers?
3. How are handles and knobs attached?

115. Fastening a Table Top. A table top may be fastened to the frame with metal table-top fasteners, with wooden blocks or cleats, 205

or with screws only. These methods allow the top to "move" when the wood shrinks or swells.

1. Table-top fasteners are short, flat pieces of steel, bent in the shape of a "Z." One end of the fastener is inserted in a groove previously cut with a circular saw on the inside surface of the rails. The other end is fastened to the table top with a single screw (E, Fig. 315).

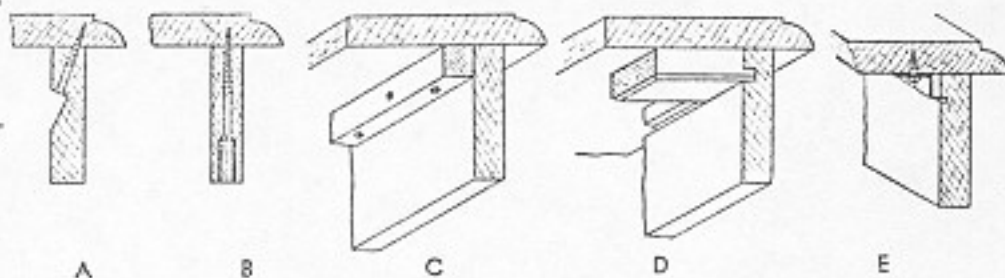


Fig. 315. Methods of fastening a table top.

2. Wooden blocks are used in the same way as the metal fasteners. Their rabbeted ends are inserted in a groove previously cut on the inside surface of the rails. They are fastened to the underside of the top with glue (D, Fig. 315).

3. A common way to fasten table tops is by means of wooden cleats about $\frac{3}{4}$ in. square. Holes for screws are bored and countersunk from two edges of the cleats at right angles to each other. The cleats then are screwed to the inside surface of the rails about $\frac{1}{16}$ in. below their upper edge. The table top is placed face down on a bench. The frame is placed on the top, and its position is located by measuring the distance from the rails to the edge of the top. Screws then are driven into the top through the holes bored in the cleats (C, Fig. 315).

4. Another way to fasten a table top is to bore holes large enough for the head of a screw part way through the rails. The depth of the hole depends upon the width of the rail and the length of the screw

to be used. The remainder of the hole is bored with a gimlet bit or a twist bit. The frame is placed on the underside of the top as described in step 3, and the screws are driven through the rails (B, Fig. 315). If desired, the holes may be plugged as shown in Figure 292.

5. Slanting holes also may be bored through the upper part of the rails (A, Fig. 315). When screws are inserted in this way, their heads should not project beyond the inside face of the rails.

QUESTIONS

1. Why should a table top never be glued to the frame?
2. Which of the methods described allows the greatest movement of the wood?

Chapter XV WOOD-FINISHING OPERATIONS

117. Sanding a Surface.
118. Inspecting a Surface before Finishing.
119. Applying Stain.
120. Filling Open-Grained Woods.
121. Filling Close-Grained Woods.
122. Applying a Wax Finish.
123. Applying a Shellac Finish.
124. Applying a Lacquer Finish.
125. Applying a Varnish Finish.
126. Painting Furniture and Interior Woodwork.
127. Brushes and Their Care.

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Chapter XV

WOOD-FINISHING OPERATIONS

When a piece of woodwork has been completed, it should be finished by brushing on various materials. The object of this is to preserve the wood and to make its surfaces more beautiful. In general there are two types of finishes, the opaque and the transparent. Opaque finish, as paint, completely covers the grain or figure in the wood, while transparent finish, as varnish, brings the grain out more clearly.



Fig. 318. Tearing sandpaper over edge of workbench.



Fig. 319. Rubbing sandpaper over the edge of bench before tearing.

Wood finishing consists of a series of operations that vary with the kind of wood employed in the construction and the use of the finished article. These operations, explained in the following, must be distinctly understood in order to be employed intelligently. The specification outlines should be referred to, and the different types of finishes may not be mixed.

117. Sanding a Surface. Sanding is the last operation to be completed before the finish is applied. It must be done carefully and well in order to produce a good surface.

The parts of a piece of woodwork that are inaccessible after gluing are sanded when the joints and all other tool work have been completed.

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Parts which are to be planed or scraped after gluing are not sanded until that process has been completed.

Sandpaper is made in rolls, and in sheets 9 by 11 in. It consists of finely ground quartz cemented to a strong, heavy paper. It is graded according to fineness, the coarsest being No. 3 and finest No. 8/0. These grades, however, are not standard with all manufacturers. For ordinary work the first sanding may be done with No. 1 or No. 1/2 sandpaper. This may be followed by No. 0 or No. 2/0, which produces a very smooth surface. Waterproof sandpaper is used with water or oil on varnished or lacquered surfaces (Art. 124). Some sandpaper is coated on both sides and is made so that it can be readily split into two sheets.



Fig. 320. Sanding with sandpaper wrapped around sanding cork.

1. All work is completed with edge tools before sanding because minute particles of quartz become imbedded in the wood surface and dull the edge tools.

2. A 9 by 11-in. sheet is divided into four parts by folding it and tearing it over the sharp corner of the workbench (Fig. 318). The coarser grades fold easier when the back of the paper is first rubbed over the edge of the bench (Fig. 319).

3. The sandpaper is stretched over a cork block about 1½ in. thick, 3 in. wide, and 4 in. long, and is held with the hand, both when sanding surfaces and edges, because more pressure can be applied and a better surface produced (Fig. 320). A block of soft wood may be substituted for the cork, but hard wood should not be used.

4. The surface always is *sanded with the grain* because even the finest scratches across the grain show badly through the finish.

5. Concave surfaces are sanded with the sandpaper wrapped around a rounded stick or a file (Fig. 321).

6. Two or more boards having identical curved edges are clamped together while the edges are being smoothed and sanded (Fig. 321).

7. Convex surfaces can best be sanded by folding a quarter sheet of sandpaper once and holding it in the hollow of the hand.

8. The corners on flat surfaces and edges should not be rounded.

9. Edges to be glued or parts of a joint never are sanded because a

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perfectly flat surface can only be produced with an edge tool. The sharp arrises between two surfaces are "broken" by running a sanding cork with a fine piece of sandpaper lightly over them.

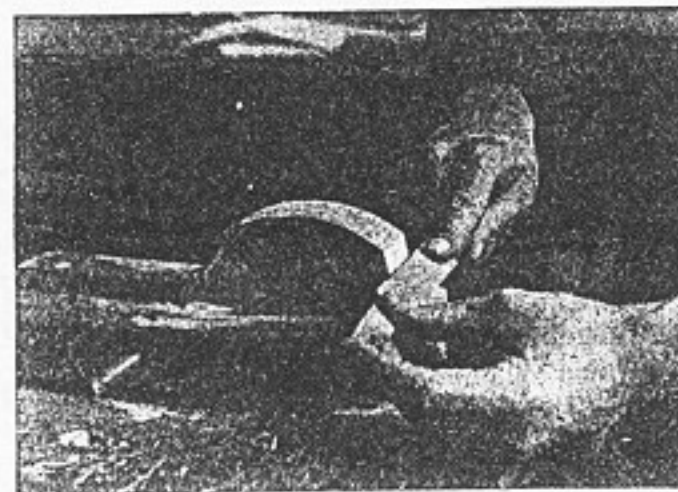


Fig. 321. Sanding concave surface, sandpaper wrapped around half-round file.

10. Too much emphasis cannot be placed on the importance of careful and sufficient sanding. It is begun with a coarse grade of sandpaper, as No. 1, and finished with No. 2/0. The work must be examined closely, so that the slightest imperfection in the surface may not be

overlooked.

11. It is well to wash the work with cold, clean water before the final sanding, because water fills up the pores of the wood and causes them to expand. The wood is allowed to dry before beginning to sand.

QUESTIONS

1. What is sandpaper made of, and how is it graded and sold?
2. If a surface is scraped after it has been sanded, what is the effect on the scraper and why?
3. How is a sheet of No. 1 sandpaper divided?
4. What is a sanding cork, and how is it used?
5. Why should wood always be sanded with the grain?
6. How may concave edges be sanded?

118. **Inspecting a Surface before Finishing.** It is of the utmost importance to prepare a surface well before applying the finish. The following points need to be checked carefully:

1. Fill holes or cracks with crack filler. There are various kinds of crack fillers on the market. One of the most common is composed

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largely of shellac and rosin. It is sold in sticks of different colors and is also called stick shellac. It looks like sealing wax and is melted into the hole or crack to be filled. It may be melted either by holding a lighted match to it or a heated iron. It hardens almost instantly and is leveled off with the surface with a scraper or chisel and sandpaper.

2. Dents in a smooth surface are caused by carelessness or accident while working. They may often be completely eradicated by placing a piece of waste soaked with water over them. The water fills up the cells in the wood causing them to swell so they come up level with the rest of the surface. When dry, the wetted part of the surface is sanded.

If the dent is very deep it is necessary to apply heat. A wet cloth is folded several times and laid over the dent. Then a hot soldering iron is placed on the wet cloth. The steam which is generated causes the wood to swell quickly. The wetted part is allowed to dry thoroughly and then it is sanded lightly.

3. Glue spots, especially around joints, are carefully removed with a chisel or a scraper and sandpaper. Every trace of glue must be removed, because it prevents the stain from coloring the wood and therefore leaves a light mark on a stained surface.

4. Oil or grease spots also prevent stain from penetrating the wood. Such blemishes are removed by rubbing them with a rag or a piece of cotton waste moistened with naphtha or benzine.

5. Sanding across the grain produces ugly scratches that are difficult to remove. It usually is necessary to sand with a coarser grade of sandpaper to completely eradicate them.

QUESTIONS

1. How are small holes or cracks in the surface filled?
2. Why can a dent often be removed by wetting it with water?
3. Why is it important to remove glue spots before staining?
4. How can oil or grease spots be removed?

119. **Applying Stain.** Stain is a transparent color applied to wood to improve its appearance or to imitate the natural color and age of more costly woods. Most stains are made from aniline colors. Some of these are soluble in alcohol (spirit stains), some in turpentine (oil stains), and some in water (water stains). Oil stains and water stains are most commonly used. Water stains give a clearer color than oil stains, penetrate more deeply into the wood, and do not fade. They have the disadvantage of raising the grain of the wood. This can be overcome by sponging the wood with clear water and sanding it with fine sandpaper after it is dry. Water stain is sold in powdered form. This is dissolved in hot water according to manufacturer's directions. If the stain becomes too dark, it is made lighter by adding water, either hot or cold.

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1. Doors, drawers, and other removable parts are taken out and stained separately.

2. The stain is brushed with the grain along the entire surface to prevent laps. When possible, the work is kept in a horizontal position, and staining is begun on the edge farthest away from the worker.

3. After dipping the brush, staining is begun on the unfinished part and is worked toward the finished part.

4. The whole surface is covered as rapidly and evenly as possible. Oil stain is wiped off, but water stain is brushed until it is dry. The brush is worked back and forth along the grain until the surface begins to dull.

5. When staining a refinished surface, a little caustic soda added to the stain makes it penetrate better.

QUESTIONS

1. How does stain differ from paint?
2. How are water stains made? What are their advantages and disadvantages?
3. How are laps prevented in staining?

120. **Filling Open-Grained Woods.** The pores or openings in wood are filled to produce a smoother surface. Filling is indispensable when a high polish is desired. Wood filler is a paste composed of gums, shellac, powdered quartz, and sand ground in linseed oil and other substances. It is used to fill the pores of open-grained woods, such as oak, chestnut, mahogany, etc.

In most cases filling is done after the wood has been stained, but when a high polish is desired, a coat of thin, white shellac should first be applied. The shellac prevents the wood from being discolored by the filler. The color of the filler usually conforms to that of the stain. Paste wood filler can be obtained in several different colors. It can also be colored by the addition of pigments ground in oil. Occasionally a filler of a contrasting color may be used; for example, a dark filler on light oak. In this case the oak is not stained, but is given a very thin coat of white shellac. When dry, this is sanded lightly with fine sandpaper, after which the filler is applied. The dark filler is forced into the pores, and the effect of this treatment is to accentuate the grain of the wood. A "weathered" appearance may be obtained by applying light filler to dark-stained oak.

1. The paste is thinned with turpentine or benzine to the consistency of cream, and it is applied freely with a fairly stiff brush, both with and across the grain.

2. After drying a few minutes (turpentine takes longer to dry than benzine), the filler changes from a glossy to a flat appearance. The

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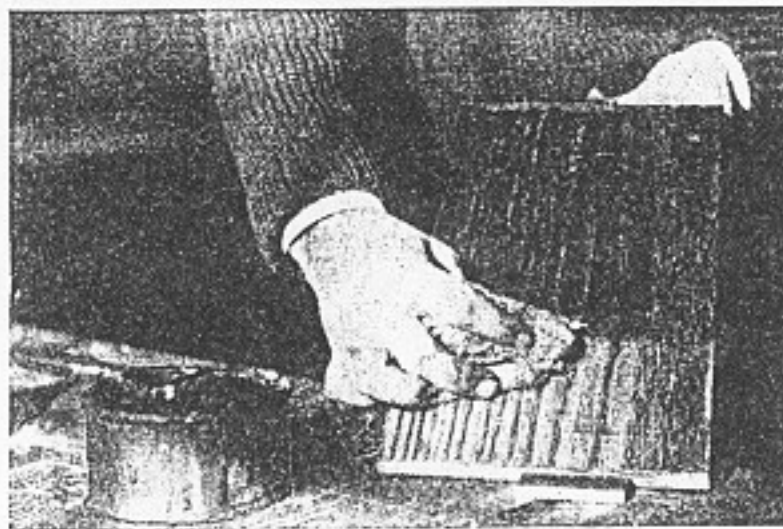


Fig. 322. Rubbing filler across the grain with a piece of burlap.

filler now is forced into the pores by rubbing it across the grain with coconut hair or a piece of burlap (Fig. 322). The surface then is inspected to see that the pores are well filled, and the surplus filler is cleaned off by rubbing along the grain with a soft cloth free from lint.

3. Another way to work the filler into the pores is by drawing a putty knife with rounded edges along the grain (Fig. 323). The knife forces the filler into the pores much more thoroughly than can be done by rubbing alone. The surplus filler is cleaned off by rubbing along the grain with a soft cloth free from lint. The filler always collects in corners of panels or where two



Fig. 323. Working filler into the pores with putty knife.

wood surfaces join each other at an angle. The filler is removed from such corners with a pointed stick of wood.

4. The filler should be allowed to dry at least 24 hours. If any wood filler has been left on the surface, it may be removed by wiping with a piece of waste moistened with

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turpentine. As little turpentine as possible should be used, because it softens the filler and may lift part of it out of the pores.

5. If the pores are not thoroughly filled, a second coat of filler is applied.

QUESTIONS

1. What is the object of filling wood?
2. From what materials is wood filler made?
3. How is wood filler prepared for use, and applied?

121. Filling Close-Grained Woods. Close-grained woods, such as birch, maple, and gum, have very small pores; and nonporous woods, such as cypress, pine, cedar, and redwood, have no pores visible to the naked eye. A thin coat of shellac is sufficient to fill such woods.

Shellac is produced by insects native to India called "lac bugs." As soon as the larvae of these insects are developed from the eggs they fasten themselves to twigs of certain trees and feed on the sap. In the course of digestion the sap is transformed into shellac and exuded through the pores in the skin of the larvae. The larvae then pass through the other stages of their development, lay their eggs and die, never leaving the twig to which they fastened themselves when they began life. New larvae are developed from the eggs, and the life cycle starts all over again.

The shellac covers the twigs of the trees, which are broken off and scraped. The raw shellac is then dried, cleaned, melted, and manufactured into large sheets, which are later broken into small pieces (flake shellac). Shellac is sold both in dry and liquid form. It is dissolved and thinned with alcohol. Four pounds of flake shellac dissolved in one gallon of alcohol is termed a 4-lb. cut and is the usual stock solution. There are two kinds of shellac on the market, orange and white shellac. White shellac is produced by bleaching orange shellac.

Shellac is rubbed down with steel wool, which consists of very fine steel shavings produced on an engine lathe. It is graded by number like sandpaper. It is especially useful in rubbing down shellac, lacquer, and varnish because it does not gum up.

1. A quantity of the stock solution is poured into a can, and an equal amount of denatured alcohol is added.
2. A rubber-set brush with fairly stiff bristles is used. On vertical surfaces, shellac is applied from the top working downward, always brushing with the grain.
3. Shellac should be applied rapidly as it dries quickly. It must not run over the edges, and if there are any runs they must be picked up with the brush immediately.

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4. From 2 to 4 hours are allowed for drying, and then it is rubbed down with No. 2/0 steel wool.
5. Shellac may not be applied over a spirit stain, because it dissolves the color, thereby giving the work a muddy appearance.

QUESTIONS

1. How is shellac produced? How is it dissolved?
2. Why is it difficult to apply shellac evenly?

3. How is steel wool made and graded?
4. Why does shellac dissolve the color in a spirit stain?

122. Applying a Wax Finish. Wax is made from beeswax, paraffin, carnauba wax, and turpentine. Carnauba wax is extracted from the leaves of a South American tree. Wax is sold both in liquid and paste form.

A wax finish is easy to produce but is not very durable. Water spilled on a waxed surface makes a dull spot, which usually can be removed or repaired by vigorous rubbing with a soft cloth.

1. Before applying a wax finish, the surface is filled, otherwise the wax is absorbed by the wood and will not produce a lustrous surface.
2. The wax is applied with a fairly stiff brush and is worked thoroughly into the wood.
3. It is allowed to dry several hours, preferably to the next day, and then is brushed with a brush having close-set bristles. An old clothes brush may be used.
4. It is finished by rubbing with a soft cloth.

SPECIFICATIONS FOR A WAX FINISH

Open-Grained Woods

- 1st coat — stain
- 2nd coat — wood filler
- 3rd coat — shellac
- 4th coat — wax

Close-Grained Woods

- 1st coat — stain
- 2nd coat — shellac
- 3rd coat — wax

QUESTIONS

1. From what materials is wax made and how is it sold?
2. Why should an undercoat be given before wax is applied?
3. How is a wax finish applied?

123. Applying a Shellac Finish. For beauty, durability, and ease of application, a shellac finish probably is the most satisfactory finish that can be produced. Shellac, especially the white, is transparent, and thus brings out the natural beauty of the wood. It need not be applied in a dust-free room because it dries very quickly.

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1. To make a pure grade of shellac, 14 ounces of flake shellac are dissolved in 1 quart of denatured alcohol. It takes about 12 hours to dissolve the shellac completely. The bottle must be shaken well until the shellac which sticks to the bottom of the bottle is all dissolved.



Fig. 324. Applying shellac with a piece of long-haired plush tacked to a block of wood.

2. The shellac is brushed on with a good brush with long bristles (Art. 117), or with a piece of long-haired plush fastened to a block of wood. The shellac is poured into a flat pan or tray, the plush block is dipped into it, and the surface is brushed back and forth along the grain (Fig. 324). This is an easy way of applying shellac evenly and free from runs and sags.

3. Four or five coats are applied with at least a two-hour interval. The surface is sanded very lightly between coats with No. 3/0 steel wool. The last coat is allowed to dry at least six hours, and then the surface is rubbed smooth and even with a piece of No. 7/0 waterproof sandpaper wrapped around a felt block. Paraffin oil or crude oil is used for rubbing.

4. Part of the surface is wiped frequently to see how the rubbing is progressing. It is easier to watch the rubbing when using paraffin oil because it is transparent. The oil is cleaned off the surface with fine sawdust which absorbs the oil. It is rubbed along the grain with the hand only. The work is completed by brushing the surfaces with a little powdered pumice stone sprinkled on a clothes brush which produces a beautiful satin finish.

5. Turned parts or carvings are brushed with a rubbing brush (Fig. 327) and powdered pumice stone and oil.

Note: The plush will remain soft if it is kept in a can with a tightly fitting cover.

SPECIFICATIONS FOR A SHELLAC FINISH

Open-Grained Woods

- 1st coat — stain
- 2nd coat — paste wood filler
- 3rd coat — shellac
- 4th coat — shellac
- 5th coat — shellac
- 6th coat — shellac

Close-Grained Woods

- 1st coat — stain
- 2nd coat — shellac filler
- 3rd coat — shellac
- 4th coat — shellac
- 5th coat — shellac
- 6th coat — shellac

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QUESTIONS

1. In what proportions should flake shellac and alcohol be mixed?
2. What is the advantage in applying shellac with plush instead of with a brush?
3. How can oil be cleaned off the surface?

124. **Applying a Lacquer Finish.** Lacquer is a complex chemical product composed of nitrated cotton, banana oil, alcohol, shellac, gum, etc. Both clear and colored lacquers are manufactured. Lacquer is usually not thinned although a special thinning fluid is made for each brand of lacquer. These thinners are not interchangeable. They are useful for cleaning the brushes after lacquering.

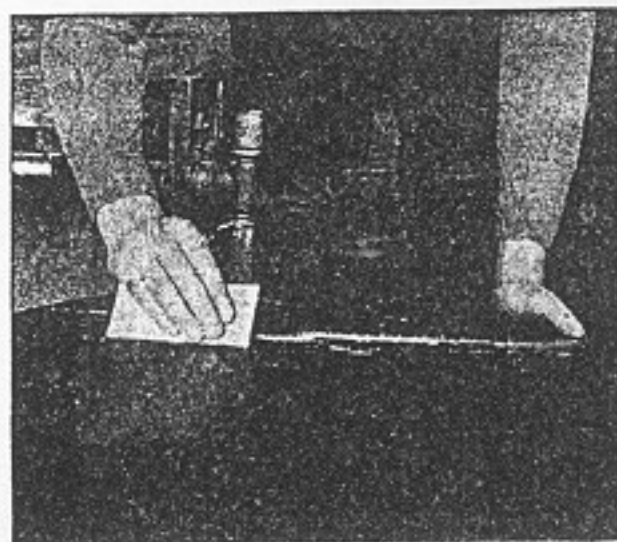


Fig. 325. Scraping lacquered surface before sanding.

Lacquer dries quickly and produces a hard, durable, and brilliant surface. Unless a thin sealing coat of shellac is first applied, lacquer cannot be used over oil stain, paste wood filler, varnish and paint, because it dissolves these undercoats, giving the finish a muddy appearance.

1. A thin shellac sealing coat is applied. At least four hours is allowed for drying, and then it is rubbed down with No. 2/0 steel wool.

2. With a soft, fitch-hair brush (Fig. 327) the lacquer is applied as it comes from the can. With plenty of lacquer on the brush, the operation is begun at one edge, and the first brush width is completed before

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the next one is started. It is smoothed with as few light strokes of the brush as possible, at the same time picking up any runs and sags.

3. A second coat is applied, allowing at least four hours for drying between coats. No sanding is necessary between coats.

4. With a very sharp hand scraper the surfaces are scraped very lightly (Fig. 325). This helps to even up the coats applied and lessens the work of sanding. Scraping, however, may be omitted and the last coat sanded directly.

5. The surface is sanded with a piece of No. 4/0 waterproof sandpaper. A rubbing pad is made by gluing or shellacking a piece of rubbing felt to a wooden block of the shape and dimensions of a sanding cork (Art. 117, step 3). The surface is wiped with rubbing oil or paraffin oil, and the sandpaper also is dipped in the oil. It is sanded with the grain, using plenty of rubbing oil, and is finished with No. 7/0 sandpaper (Fig. 326).

6. The surface is cleaned off with a piece of waste. It then is covered with fine sawdust and wiped along the grain, using the hands only. The sawdust absorbs the oil left on the surface.

7. Some powdered pumice stone is sprinkled on the bristles of a clothes brush and the surface is brushed briskly and thoroughly. This removes the last traces of the rubbing oil and produces a fine, satin



Fig. 326. Rubbing down lacquered or varnished surface.

finish.

8. If a brilliant polish is desired, the surface is rubbed with polishing cream applied with a fine linen rag or a piece of silk hose.

9. It is evident that a surface to be rubbed must be finished very

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carefully with scraper and sandpaper so that it is absolutely flat; otherwise the finish will be rubbed through at the high spots.

SPECIFICATIONS FOR A LACQUER FINISH

Open-Grained Woods

- 1st coat — stain
- 2nd coat — shellac
- 3rd coat — paste wood filler
- 4th coat — sealing coat of shellac
- 5th coat — lacquer
- 6th coat — lacquer

Close-Grained Woods

- 1st coat — stain
- 2nd coat — shellac filler
- 3rd coat — lacquer
- 4th coat — lacquer

QUESTIONS

1. What would happen if lacquer were applied directly over the wood filler?
2. What kind of brush should be used for lacquering?
3. What would you use for cleaning a lacquer brush?
4. What materials are used for rubbing a lacquered surface?
5. How is oil removed from a lacquered surface?
6. What is likely to happen if the surface is not absolutely flat?

125. **Applying a Varnish Finish.** Varnish consists of copal gums dissolved in linseed oil. Copal gum is petrified resin from prehistoric pine trees. These gums are found buried in the ground in certain parts of the tropics. Varnish is thinned with turpentine. It produces a beautiful finish on wood and is used extensively on all fine furniture, pianos, radios, etc.

In addition to waterproof sandpaper, varnish may be rubbed with powdered pumice stone and rottenstone. Pumice stone is a porous white stone of volcanic origin. Rottenstone is a brown shale or claylike rock.

1. Varnishing should be done in a dust-free room heated to a temperature of 80 deg. To remove every speck of dust, the surface is rubbed with a rag moistened in turpentine. Some varnishes should be applied directly over the wood filler, because a shellac undercoat may cause them to scale. This is especially true of quick-drying varnishes not intended for rubbing. Cabinet rubbing varnishes often give better results with a shellac undercoating.

2. The varnish is applied as it comes from the can, it is spread evenly, and is finished with light strokes of the brush along the grain.

3. Manufacturers' directions should be followed as to time for drying. Some varnishes require 48 hours or more, while others dry hard in less than half this time. The surface is sanded between coats, because varnish does not adhere to a glossy surface. No. 5/0 waterproof sandpaper is used to avoid dust. The paper is soaked in water a few minutes before using, and the surface to be sanded also is moistened.

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4. At least three coats are applied, and the last coat is finished by rubbing with FF powdered pumice stone and rubbing oil or water. A higher polish is obtained by continuing the rubbing with rottenstone, which is finer than pumice stone.

5. The surface is cleaned, and it is finished by rubbing with a linen rag moistened with polishing oil.

SPECIFICATIONS FOR A VARNISH FINISH

Open-Grained Woods

- 1st coat — stain
- 2nd coat — shellac
- 3rd coat — paste wood filler
- 4th coat — shellac
- 5th coat — rubbing varnish
- 6th coat — rubbing varnish

Close-Grained Woods

- 1st coat — stain
- 2nd coat — shellac
- 3rd coat — rubbing varnish
- 4th coat — rubbing varnish

QUESTIONS

1. What is copal gum, where is it found, and for what is it used?
2. What liquid is used for thinning varnish?
3. How is a shellac undercoat liable to affect a varnish finish?
4. Why should varnish be sanded between coats?
5. What materials are used for rubbing a varnished surface?
6. How can you tell the difference between pumice stone and rottenstone?

126. **Painting Furniture and Interior Woodwork.** Paint is called an opaque finish, because it covers the surface so that the natural figure (grain) of the wood is invisible. It is therefore used mostly on cheaper kinds of wood lacking in natural beauty. Other opaque finishes are colored lacquers and metallic leafs and powders.

Paint is made of white lead or zinc white, linseed oil, turpentine, and driers. White lead and zinc white are metallic compounds obtained respectively from lead and zinc. White lead is very poisonous.

Linseed oil is pressed from flaxseed. It is sold either raw or boiled. It dries by oxidation or contact with the air. Boiled linseed oil dries faster than raw linseed oil and is, therefore, always used for inside work.

Driers cause the paint to dry faster. They are made from gums, shellac, linseed oil, metallic oxides, and turpentine.

The processes of applying inside paint may be listed under the following general headings: preparing the surface, applying the priming coat, applying the undercoats, and applying the finishing coats.

Preparing the Surface. 1. The surface is inspected as described in Article 118.

2. A coat of thin shellac is applied to soft woods, such as basswood

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and whitewood. This prevents the wood from absorbing too much of the oil from the paint. It also binds the fine, hairlike fibers together, so that the painted surface will be smooth instead of fuzzy. When dry, it is sanded lightly with No. 2/0 sandpaper.

3. A coat of thin shellac is applied to knots and pitchy woods, such as yellow pine, to prevent the pitch from penetrating and discoloring subsequent coats of paint. When dry, it is sanded lightly with No. 2/0 sandpaper.

4. A coat of paste wood filler is applied to porous woods, such as oak, chestnut, and ash, before they are painted (Art. 120).

5. **Applying the Priming Coat.** The priming coat consists of paint thinned with boiled linseed oil and turpentine. A claylike substance called French yellow ochre usually is added to the priming coat, because it helps to cover the surface. Primers can be bought ready-made.

6. The paint is applied evenly with a brush having long bristles, and it is left to dry from 12 to 24 hours.

7. It is then sanded with No. 0 sandpaper until all brush marks have disappeared and the surface is smooth.

8. Holes or other imperfections in the surface, which are more noticeable after painting, are filled with putty or Danish whiting mixed with a little thin glue. Nail holes are filled by using the fingers instead of a putty knife. Whiting is powdered chalk. It does not crack nor shrink after drying.

9. **Applying the Undercoats.** The second undercoat is applied in the same manner as the priming coat, but paint of the desired color is used. One pint of turpentine is added to each gallon of paint.

10. From 12 to 24 hours are allowed for drying, and then it is sanded with No. 2/0 sandpaper.

11. A third undercoat is applied as it comes from the can.

12. Twenty-four hours are allowed for drying, and then it is sanded with No. 2/0 sandpaper.

13. **Applying the Finishing Coats.** Enamel, which is a colored varnish, generally is used for the finishing coats. For the first coat equal parts of the paint used for the last undercoat and the enamel are

mixed. This is left to dry for 36 hours, and then it is sanded with No. 3/0 sandpaper.

14. Before applying the last coat, the surface is wiped with a chamois skin to remove all dust. The enamel then is applied as it comes from the can, with a softer brush. Enameling, like varnishing, should be done in a dust-free room heated to about 80 deg. Both enamel and paint are obtainable in flat or glossy finishes.

15. The work is left to dry for about four days, and then it is rubbed down with pumice stone and water as described in Article 125.

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QUESTIONS

1. What are the chief ingredients of paint?
2. From what materials are yellow ochre, whiting, and linseed oil manufactured?
3. Why is basswood given a coat of shellac before painting?
4. Why is yellow pine given a coat of shellac before painting?
5. How does enamel differ from paint?

127. **Brushes and Their Care.** Brushes for wood finishing are made of different materials and in different shapes and grades. Like other tools, it pays to buy brushes of good quality, because better work can be produced with them. If properly cared for they last a long time. The following brushes are commonly used by woodworkers:

1. Glue brushes are made of rather coarse bristles set in vulcanized rubber. They are either round or flat. The round is the most common and is made in sizes from $\frac{3}{8}$ to $1\frac{1}{2}$ in. Glue brushes for casein glue are made of stiff fibers.

2. Stain brushes are made of black Chinese bristles set in rubber. They are obtainable in widths from $\frac{3}{4}$ to 3 in. and are usually of only single thickness.

3. Varnish and paint brushes are made from long black Chinese bristles in double or triple thickness and vulcanized in rubber. They are bound in heavy nickel or steel ferrules and their ends are usually "chisel pointed." They are manufactured in flat and oval shapes and in widths from 1 to 4 in.

4. Lacquer brushes are also called fitch brushes and are made in double thickness from soft hair set in rubber. They are flat, and range in widths from 1 to 3 in.

5. Rubbing brushes are made from short, stiff bristles bound in wood. They are used for rubbing down shellac, varnish, or lacquer on turned and carved parts (Fig. 327).

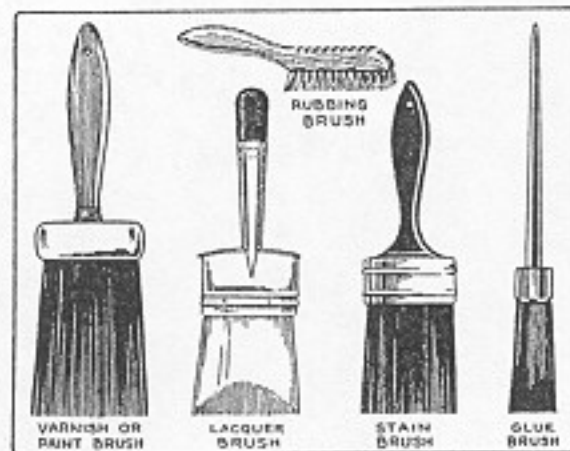


Fig. 327. Brushes.

6. It is of the utmost importance in all wood finishing, not only to use good material and brushes, but also to keep them clean and in good condition.

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7. Brushes should be used only for one kind of finishing material. For example, shellac brushes should be used only for shellac, varnish brushes only for varnish, and so on.

8. It should always be kept clearly in mind what solvent to use for the different finishing materials.

Finishing Material

Water stain
Oil stain
Spirit stain
Wood filler
Linseed oil
Shellac
Lacquer
Varnish
Paint

Solvent

Water
Turpentine
Alcohol
Turpentine or benzine
Turpentine
Alcohol
Special thinner
Turpentine
Turpentine and linseed oil

9. Stain brushes always are washed out in their proper solvent after

using, and are kept dry. Oil-stain brushes never are used for water or spirit stains.

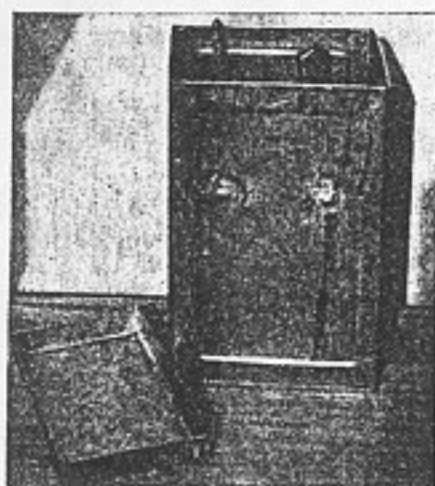


Fig. 328. Brush safe.



Fig. 329. Double can for varnish brushes.

10. Filler brushes are hung in a closed container called a brush safe, so that they do not touch the bottom, and their bristles are covered with turpentine. This causes the filler to dissolve and settle on the bottom of the can (Fig. 328). Paint brushes are treated in the same way, but an equal amount of raw linseed oil is added to the turpentine.

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11. Shellac, lacquer, and varnish brushes are kept in separate containers, each partly filled, respectively with shellac, lacquer, and varnish. Such a container may be made of two quart cans fitting closely together (Fig. 329). The brush is hung on a nail soldered to its side. When a piece of work is being done, the upper can is lifted off and the contents of the lower can is used. The brush always is ready and pliable, because it is kept in the proper liquid. The can should be replenished when needed, and the liquid always must cover the bristles of the brush. The can must be emptied and cleaned occasionally because particles of grit and dirt in time will be transferred by the brush to the can.

QUESTIONS

1. How many different finishing materials can be thinned with turpentine?
2. Why should filler brushes be suspended in the brush safe?

Chapter XVI

JOB-SHEET OUTLINES

129. To Work from Job Sheets and Blueprints.
130. To Make a Wastebasket.
131. To Make a Bird House.
132. To Make a Hanging Bookrack.
133. To Make a Smoking Stand.
134. To Make a Writing Table.

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Chapter XVI

JOB-SHEET OUTLINES

129. To Work from Job Sheets and Blueprints. By a job is understood a series of tool operations or processes necessary to produce a complete piece of work. Larger jobs are often subdivided into smaller jobs or units. For example: To square a piece of wood to dimensions is a job, because it involves several tool processes, as measuring, marking, edge planing, face planing, end planing, sawing, and so forth. Likewise, to make a joint, to attach a hinge, to produce a finish on wood are all jobs, each one of which involves many tool operations. To make a piece of furniture is also a job, but a bigger job, because it includes many smaller jobs and a great many tool operations.

A blueprint, with or without written specifications, is in reality a job sheet. The experienced workman needs no further explanation, for he understands his work so well that he can see from the blueprint

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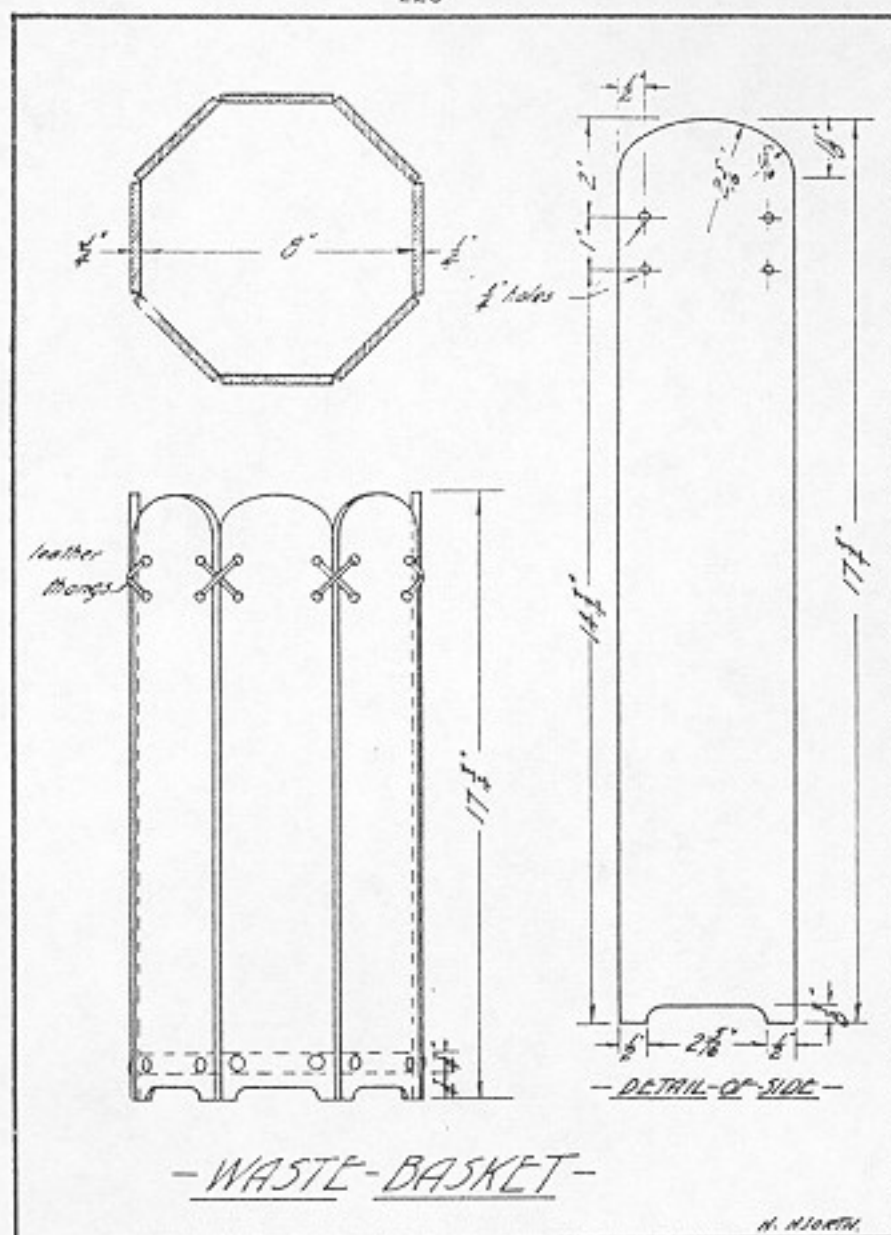


Fig. 332.

not only what tools and materials are needed, but also — and this is very important — in what order the various tool operations should be performed.

The learner or inexperienced workman, however, needs further explanations and directions, especially in planning the work. These directions are usually written or printed on a separate sheet called a job sheet.

As he gains in experience he will be able to do more and more of the planning himself, and after a while he will know how to analyze his problem correctly and work independently from a drawing or a blueprint. In the following job sheets an opportunity is given to do some of the planning, such as making out stock lists, calculating the amount of materials needed, making templates, looking up references, and so on.

130. TO MAKE A WASTEBASKET

General Directions: Read the instructions carefully. Bring the bill of material, the cardboard patterns of the top and bottom of one sidepiece, and the answers to the questions to your instructor for his approval.

1. Study the drawing, make out a bill of material, and calculate the number of board feet needed for this job (Arts. 9 and 10).

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2. Get a piece of cardboard about 4 in. square. Lay off the width of one sidepiece and draw a center line. Lay out the shape of the top on one end and of the bottom on the other end of the cardboard (Art. 16).
3. Select a straight, flat piece of 1/4-in. stock. Allow an extra 1/2 in. both on the length and the width, and measure all the sidepieces at the same time, making their ends square (Art. 12, step 1, and Art. 15).
4. Saw across and along the grain on the waste side of these lines (Arts. 24 and 27).
5. Plane one edge on each of the sidepieces (Art. 36).
6. Gauge the width of each sidepiece from the planed edge (Art. 13).

Gauge all the sidepieces at the same time with the same setting of the gauge.

7. Plane one end on each sidepiece square to the planed edge (Art. 39, step 2). The squared end is to be the lower end of the sidepiece.

8. Plane the other edge on each sidepiece to the gauge line.

9. Plane the wide surfaces of the sidepieces lightly with a very sharp jack plane (Arts. 34 and 35).

10. Measure the length of the sidepieces from the squared end and lay out the curves from the template. Saw with a coping saw (Art. 31).

11. Clamp all the sidepieces together with a hand screw and smooth the curved edges with a half-round cabinet file and sandpaper (Art. 117).

12. Lay out and bore the holes on all the sidepieces (Art. 22, step 3, and Art. 56).

13. Sand with No. 1/2 and No. 0 sandpaper (Art. 117).

14. Get out the stock for the bottom, allowing 1/2 in. both on the width and length. Square this board to exact dimensions (Art. 45).

15. Lay out an octagon from this square (Art. 19, step 2), saw off the corners 1/16 in. outside the lines, and plane the edges straight and square to the lines.

16. Square a pencil line across the inside surface of each sidepiece, 3/4 in. from its lower end. Nail the sidepieces to the bottom so that the pencil line is flush with the lower edge of the bottom. Nail opposite sides first (Art. 106). Use two 1 1/4-in. brads, and place them so that they later will be covered by the larger upholsterer's nails.

17. Tie the sidepieces together temporarily with cord and apply water stain (Art. 119). Finish with shellac (Art. 123).

18. Tie the sidepieces permanently together with narrow leather strips and drive the upholsterers' nails in place.

QUESTIONS

1. Why should the width of all the sidepieces be gauged at the same time?
2. Why is only one end of each sidepiece squared?

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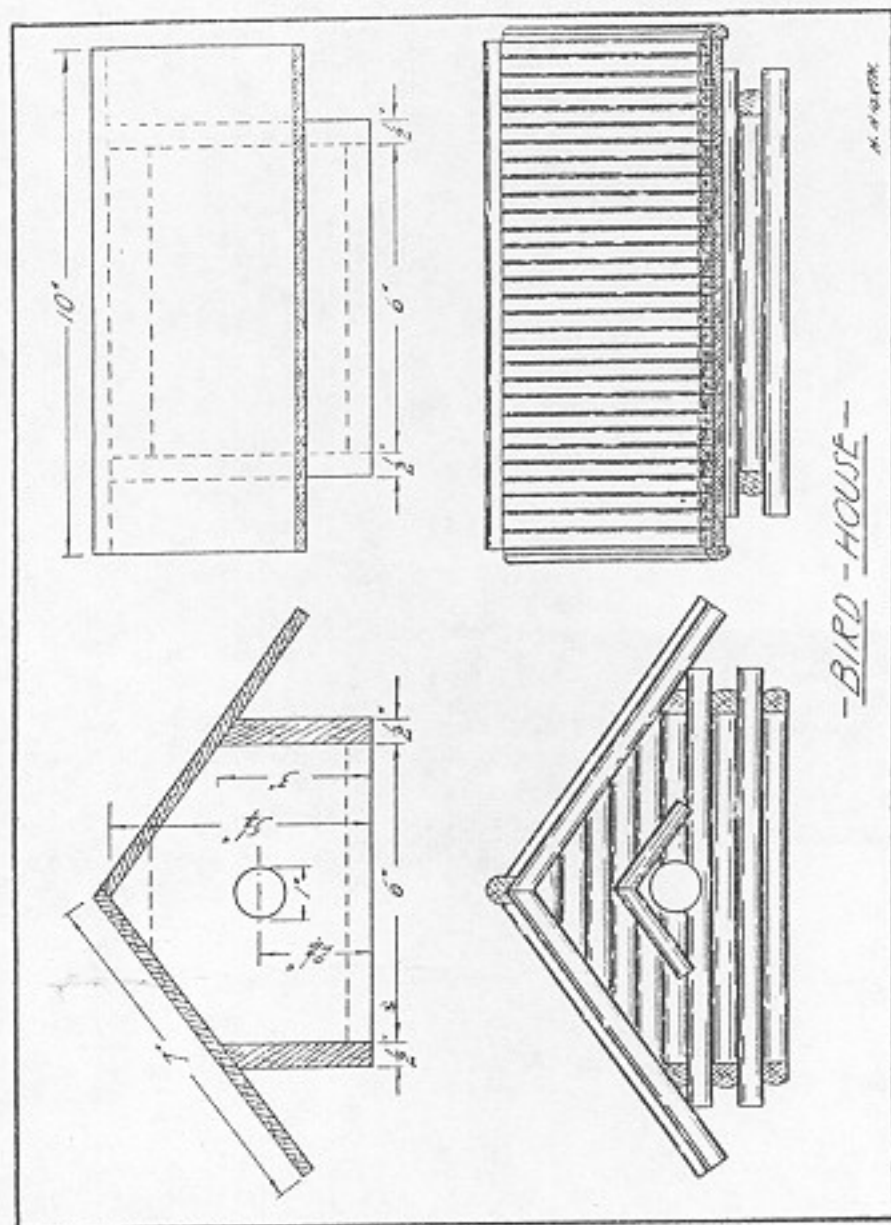


Fig. 333.

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3. How should the sidepieces be placed when laying out the holes for the leather thongs?

131. TO MAKE A BIRD HOUSE

General Directions: Read the instructions carefully. Write out the answers to the questions and bring these, the bill of material, and the templates to your instructor for his O.K.

1. Study the drawing attentively. The detail drawing shows the different parts of the house as well as an isometric sketch of its construction.

2. Make out a bill of material (Art. 9), and make templates or full-sized patterns of ends, sides, bottom, and roof.

3. Select a straight, flat, machine-planed board, 1/2 in. thick and about 6 1/2 in. wide. Plane one edge (Art. 36), lay the patterns of the ends, sides, and bottom on this edge, and mark around them.

4. Saw a little outside the lines marked (Art. 25). Nail the two ends together and plane to the lines. Do the same with the sides.

5. Bore a 1-in. hole in one of the ends (Art. 56), tipping the bit slightly upward. Slanting the hole in this way will prevent rain water from dripping into the house.

6. Nail the ends and sides together as shown, beveling the sides to conform to the angle of the ends. Use 1 1/4-in., No. 16 brads (Art. 106).

7. Cut and plane the ridge brace as shown, and nail it in place.

8. Hinge, nail, or screw the bottom in such a way that it may be taken out for cleaning the house once every season.

9. Now cover the sides and ends with "logs," which are ripped from a 1/2-in. board. First plane the edge of the board, then gauge a line 1/2 in. from the edge and saw outside this line (Art. 27). Plane the sawed edge, and round the outside surface of the "log."

10. Make the roof of two 1/4-in. boards. Do not use plywood, because it buckles and comes apart in damp weather. Cypress, cedar, or redwood are best for outside work. After the boards are nailed in place, flatten the sharp ridge with a plane until it is 1/2 in. wide. Nail the ridge "timber" to this, after which nail the roof "timbers" as shown. These may be cut from a 1/4-in. board. Use 3/4-in., No. 18 brads.

11. Paint the house with a dark-colored, flat paint suitable for outside work (Art. 126). The house also may be stained and given two coats of raw linseed oil.

QUESTIONS

1. What kinds of wood are suitable for a bird house? Could plywood be used?
2. Why should the sides and ends be nailed together before planing?

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3. How should the hole be bored in the end?
 4. Why are holes bored in the bottom?
 5. How are the "logs" made?
 6. Why should the house not be painted with bright colors?
 7. Which brad is thicker, No. 16 or No. 18? Which screw is thicker, No. 6 or No. 8?
- Reference: L. H. Baxter, *Boy Bird House Architecture*, pages 16 to 23.

132. TO MAKE A HANGING BOOKRACK

General Directions: Study the instructions carefully. Bring the bill of material, the cutting list, the template, and the answers to the questions to your instructor before beginning the work.

1. Study the drawing, make out the bill of material and the cutting list, and calculate the number of board feet needed for this job (Arts. 9 and 10).

2. Make a template for the upper and lower parts of the sides (Art. 20). Select a straight, planed board, and lay out the sides on the board as shown in the drawing.

3. Square a line across the board (Fig. 39), and saw off the piece marked (Art. 24). Lay out and saw the three shelves in the same way.

4. Saw out the sides with a turning saw (Art. 30).

5. Clamp the two sides together in the bench vise and smooth the curved edges with a half-round file and sandpaper (Art. 117). Also plane the front and rear edges of the sides straight and square (Art. 36).

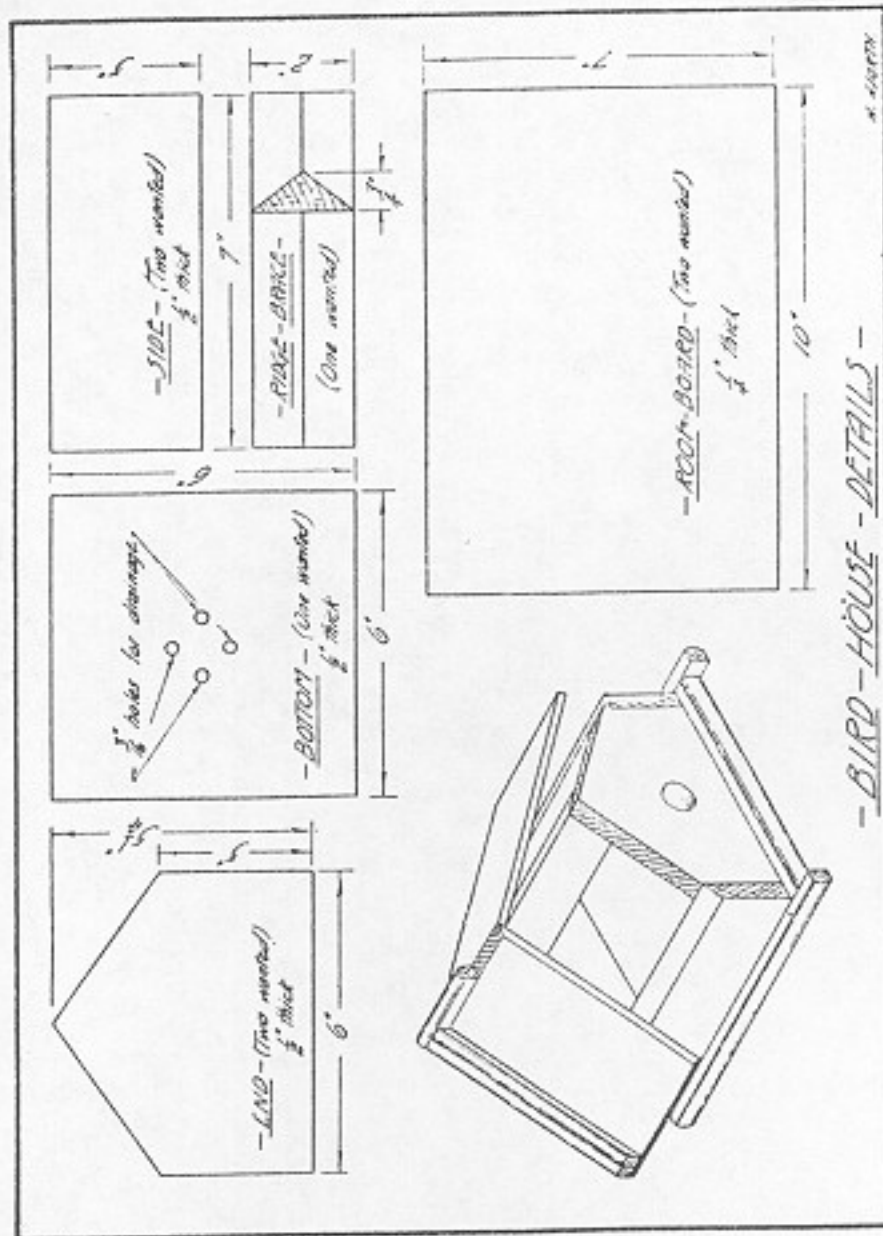
6. Smooth the wide surfaces with a jack plane (Art. 35). Cross-grained hard woods, which have been machine-planed, should be smoothed with a cabinet scraper (Art. 42).

7. Square the three shelves to dimensions (Art. 45). Smooth the wide surfaces as explained in step 6, taking care not to make the shelves too thin.
8. Lay out and cut the stopped dado or gain joints (Arts. 22 and 70).
9. Sand shelves and sides with No. 1/2 and No. 2/0 sandpaper (Art. 117).
10. Glue the shelves together (Arts. 100 and 102).
11. When dry, plane the edges of the shelves and sides until they are perfectly level and flat. Smooth with sandpaper.
12. Inspect the surfaces (Art. 118), apply water stain (Art. 119), and finish with shellac (Art. 123).

QUESTIONS

1. How long a board is needed for the two sides?
2. Should the shelves be planed to thickness before the joints are made? If not, why not?
3. Is a gain joint cut with a chisel or a backsaw?
4. How can the dados be laid out correctly on both sidepieces?

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133. TO MAKE A SMOKING STAND

General Directions: Read the instructions carefully, and write out the answers to the questions. Present these, the bill of material, and the cutting list for your instructors' approval.

1. Study the drawing of the smoking stand, make out a bill of material and a cutting list, and calculate the number of board feet needed for this job (Arts. 9 and 10).
2. Get out the stock for the four legs and the two cross-lap joints, and square these pieces to dimensions (Art. 47).
3. Make the two cross-lap joints (Art. 80).

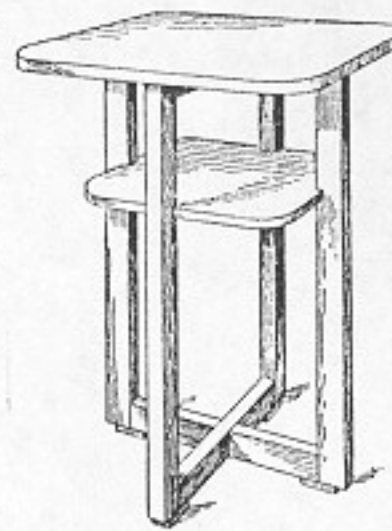


Fig. 336. Smoking stand.

4. Lay out, cut, and fit the eight mortise-and-tenon joints (Art. 92).
5. Square the shelf to dimensions (Art. 46), round its corners (Art. 16, steps 1 to 3), and lay out and cut the dados for it in the legs (Art. 69).

6. Bore four holes for 1 3/4-in. No. 12 flat-head screws through the upper cross-lap joint, about 2 inches from the tenons (Art. 61). Countersink these holes on the underside (Art. 65).

7. Smooth all the parts with sandpaper (Art. 117), before gluing the stand together (Art. 100).

8. Plane off any unevenness between the ends of the legs and the cross-lap joints.

9. Make the four small feet 1/2 by 1 by 2 in. It is best to plane a piece of stock to the following dimensions, 1/2 by 1 by 9 in., and then saw off the legs from this (Art. 28). Glue and screw the feet in place as shown in the drawing.

10. Joint the edges of three boards, 7/8 by 6 by 17 1/2 in., for the top (Art. 37). Glue these together (Art. 101), and square the top to dimensions (Art. 46).

11. Lay out the round corners (Art. 16, steps 1 to 3), and saw them with a turning saw (Art. 30). Finish with a spokeshave (Art. 41).

12. Smooth the top with sandpaper (Art. 117), and place it face down on the workbench. Center the stand on the top by measuring from the edge of the top to the face of the legs, and fasten together with screws.

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13. Give the stand a final sanding with 2/0 sandpaper and inspect it carefully (Art. 118). Apply water stain (Art. 119). When dry, apply a coat of wood filler (Arts. 120 and 121). Finish with three coats of lacquer (Art. 124). Striking modernistic effects may be obtained if a colored lacquer is used on the edges.

QUESTIONS

1. Why should all the mortise-and-tenon joints be laid out at the same time?
2. What is the advantage of making the feet as explained in step 9?
3. What kind of wood filler should be used and why?
4. What precautions must be taken before applying lacquer over paste wood filler? Why?

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134. TO MAKE A WRITING TABLE

General Directions: Study the drawing and instructions carefully. Answer the questions, and check your bill of material and cutting list with the instructor before beginning work.

1. Make out a bill of material from the drawing (Art. 9). Make out a cutting list from your bill of material, and calculate the number of board feet (Art. 10).
2. Get out stock for the legs, rails, and stretchers. Square these pieces to dimensions (Art. 47).
3. Place the legs side by side and cut them to the same length (Arts. 22 and 29). Do the same with end rails and stretchers and the rear rail and stretcher.
4. Lay out and cut all the mortise-and-tenon joints at the same time (Art. 92). Use table-haunched mortise-and-tenon joints on the rails (Art. 93, step 4).
5. Glue the two ends of the table together (Art. 103).
6. Get out the stock for the frame, plane the inside edges, and cut the 20-in. pieces to exact length.
7. Lay out and make the dowel joints (Art. 83).

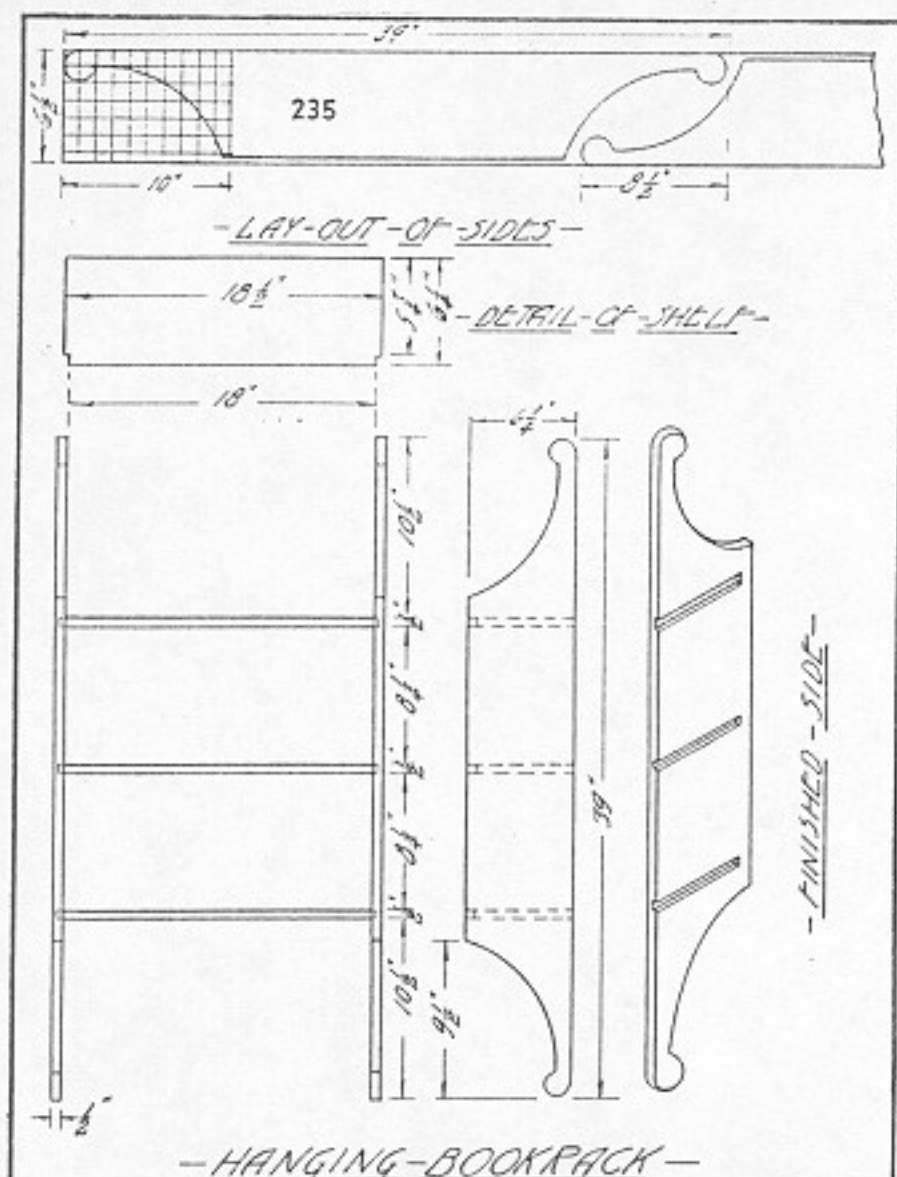


Fig. 335.

N. N. NORTH

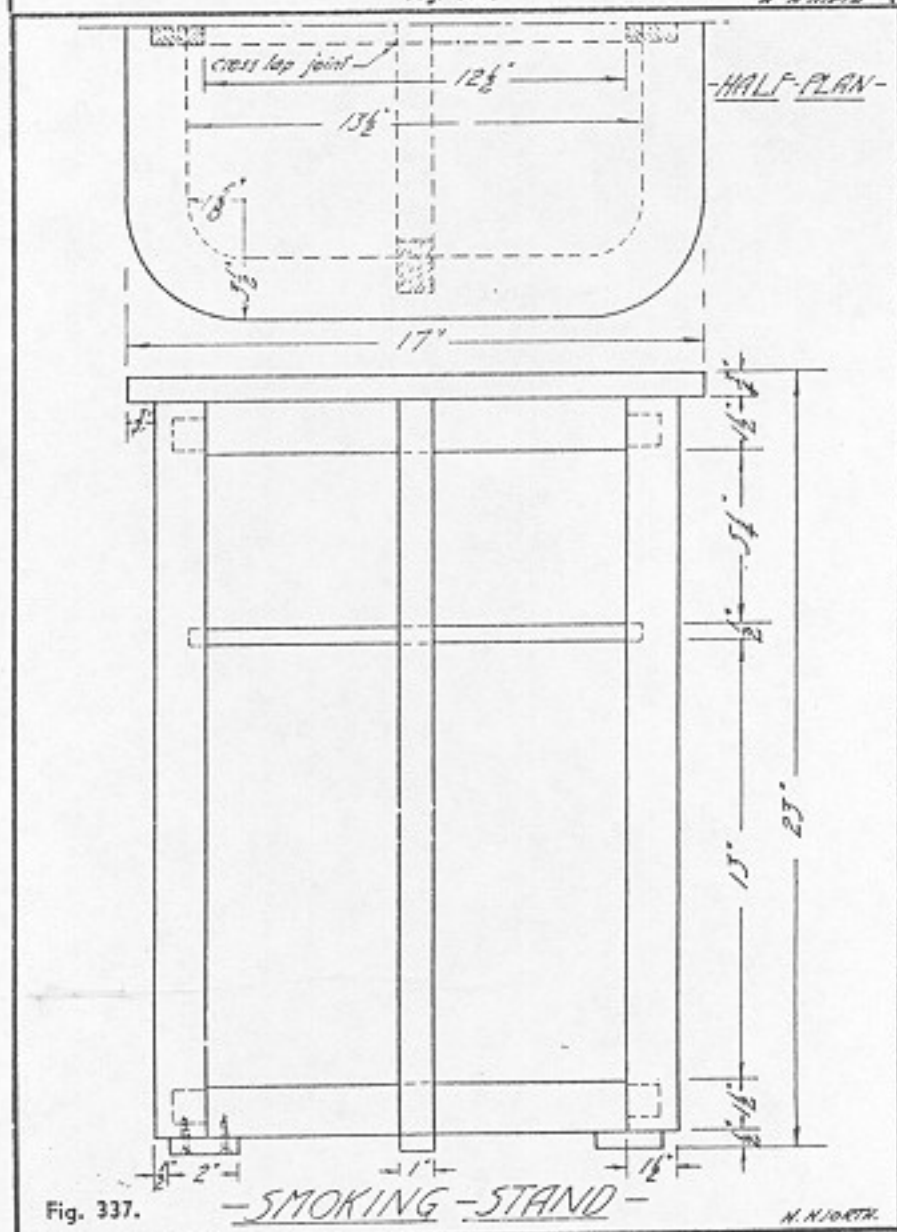


Fig. 337.

N. N. NORTH

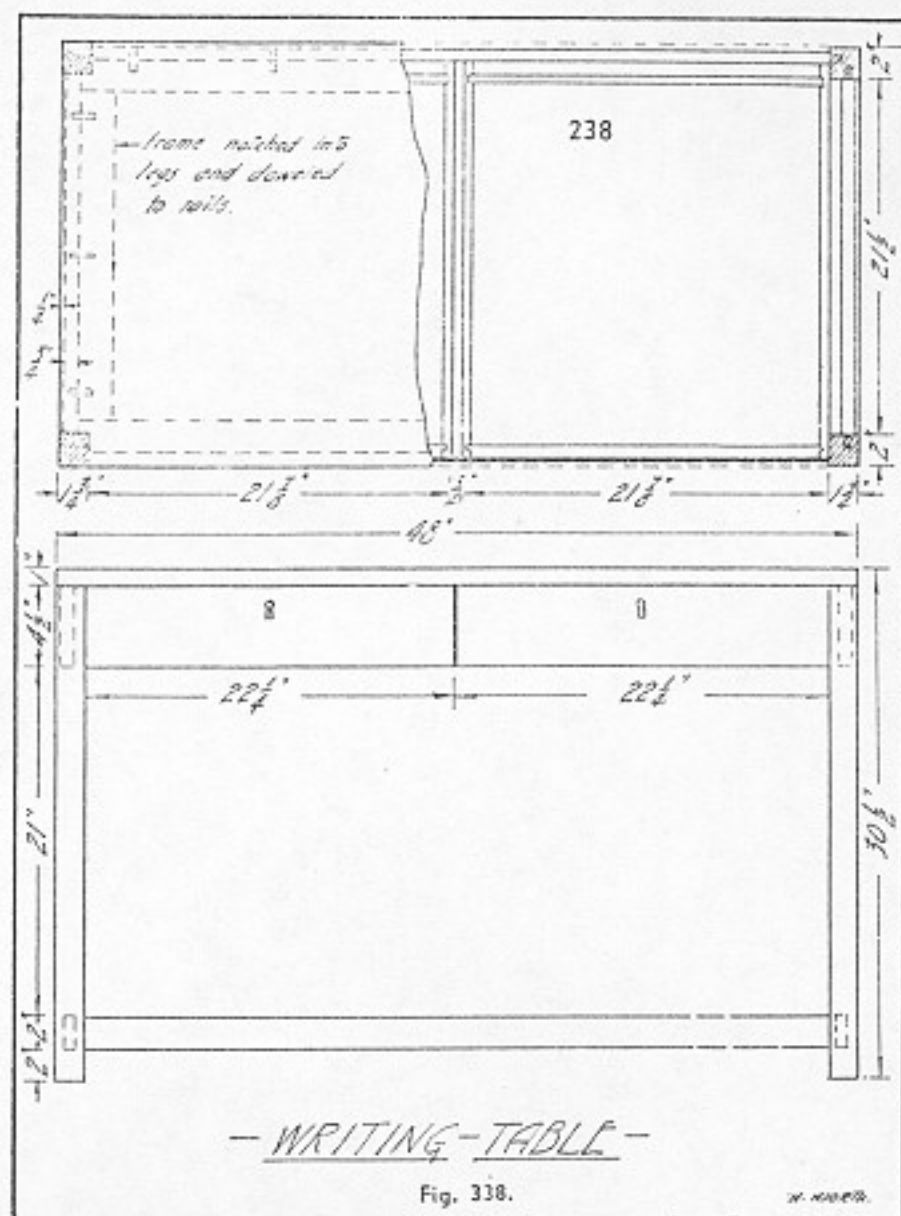


Fig. 338.

N. N. NORTH

8. Cut the plywood panels to dimensions, and plow the grooves for them in the doweled members (Art. 71).

9. Glue the frame together (Art. 97, step 5).

10. When dry, smooth the faces, and plane the outside edges until the frame fits in between the rails of the table.

11. Notch the frame into the legs and dowel it to the rails (Art. 85).

12. Glue the two ends, the frame, the rear rail, and the rear stretcher together (Art. 103).

13. Now screw or dowel the rear rail and the frame together.

14. Make the two drawers as explained in Article 74. It is recommended to cut the plywood fronts so that the grain runs up and down instead of from side to side.

15. Prepare three drawer guides $\frac{3}{4}$ in. square and 24 in. long. Fit two of them in between the legs on each side, and the third one in the center between the drawers. Nail or screw these guides to the frame and plane and adjust them until the drawers work easily and smoothly.

16. Now glue up the top and plane it to dimensions (Arts. 46 and 101). You may fasten it to the rails with table-top fasteners or with screws through the rails (Art. 115). Place a straightedge across the end rails to see that the sides of the drawers are not too high before the top is screwed in place.

17. Next attach the locks to the drawers (Arts. 111 and 112). Use thread escutcheons (Art. 112, step 15).

18. Give the writing desk a final sanding (Art. 117) and thorough inspection (Art. 118) before applying the stain (Art. 119).

19. If the desk is made of oak or other open-grained wood, apply one or two coats of paste wood filler (Art. 120). Finish with three coats of varnish (Art. 125).

QUESTIONS

1. How can you lay out the shoulder cuts on the tenons so that corresponding rails and stretchers will be of exactly the same length?
2. How should the shoulder cuts be made?
3. How can the two ends be glued without twisting the legs?

4. Why are the panels in the frame and the bottoms in the drawers not glued?
5. Why is the plywood front flush with one side of the drawer but overlapping the other?
6. What types of locks are suitable for those drawers?

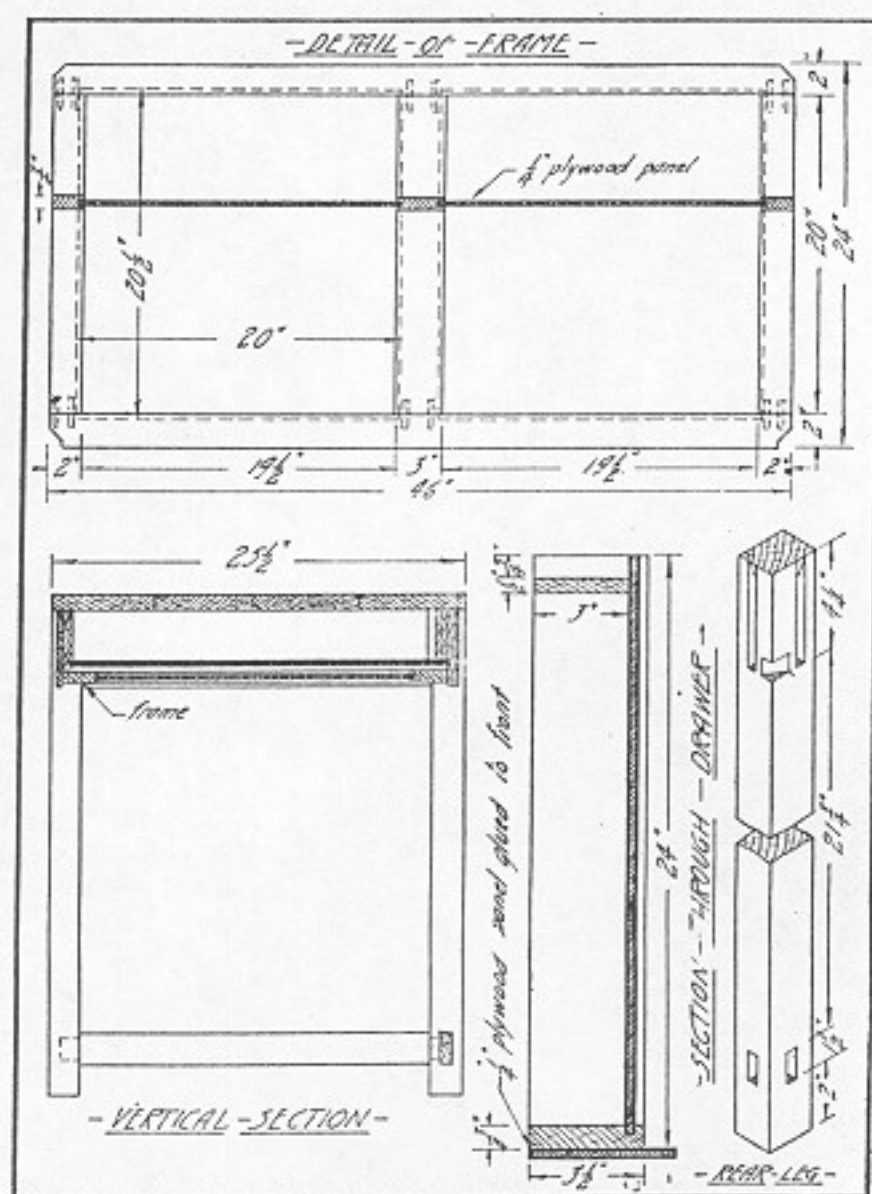


Fig. 339.

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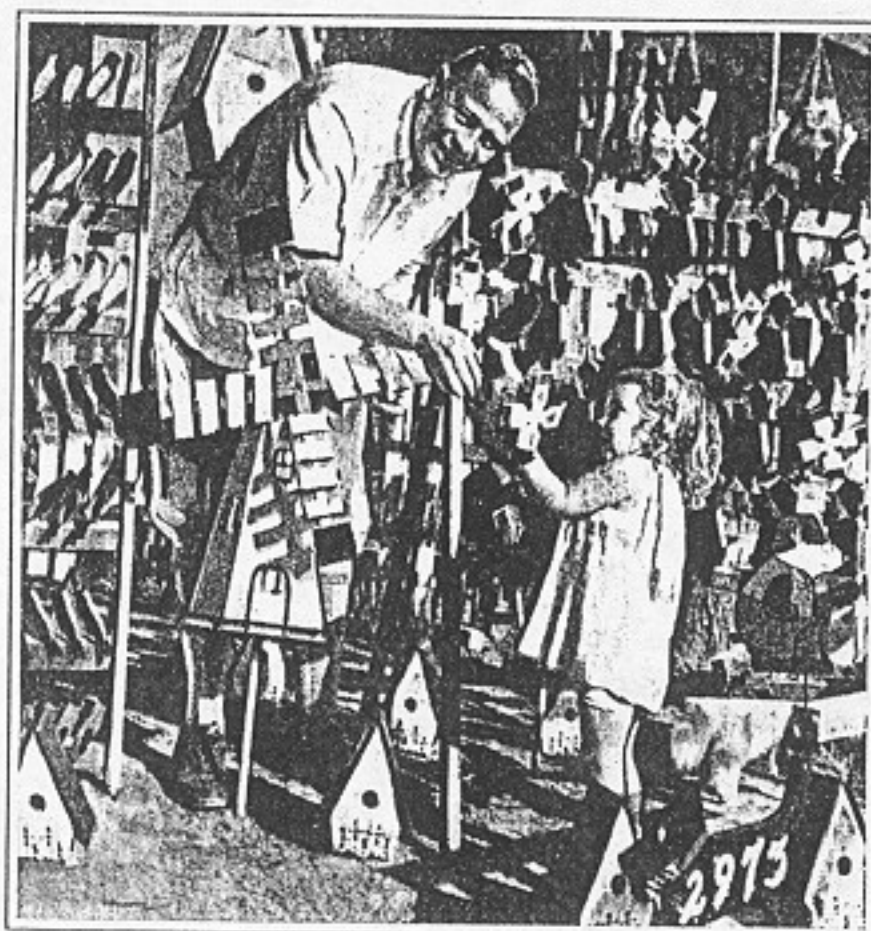
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POPULAR MECHANICS

January, 1932

TOY WINDMILLS MAKE LIVING FOR MAN WITH HOBBY

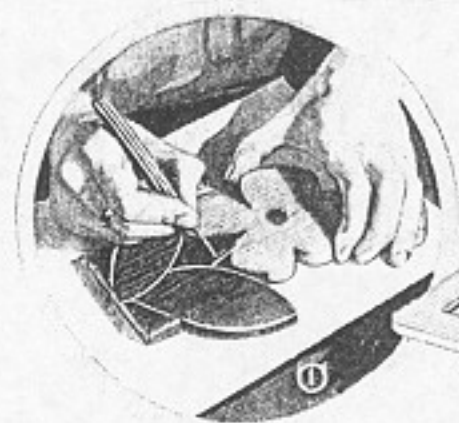
One California man makes a good living by building toy windmills for children. Faced with a breakdown in health, this man moved to a California beach and began looking around for something to occupy his time. He started building the windmills for near-by children, but the toys became so popular that he soon had a long line of tourists stopping at his door to see the display of toys and garden sticks, and he now sells more than 7,000 of them each month.



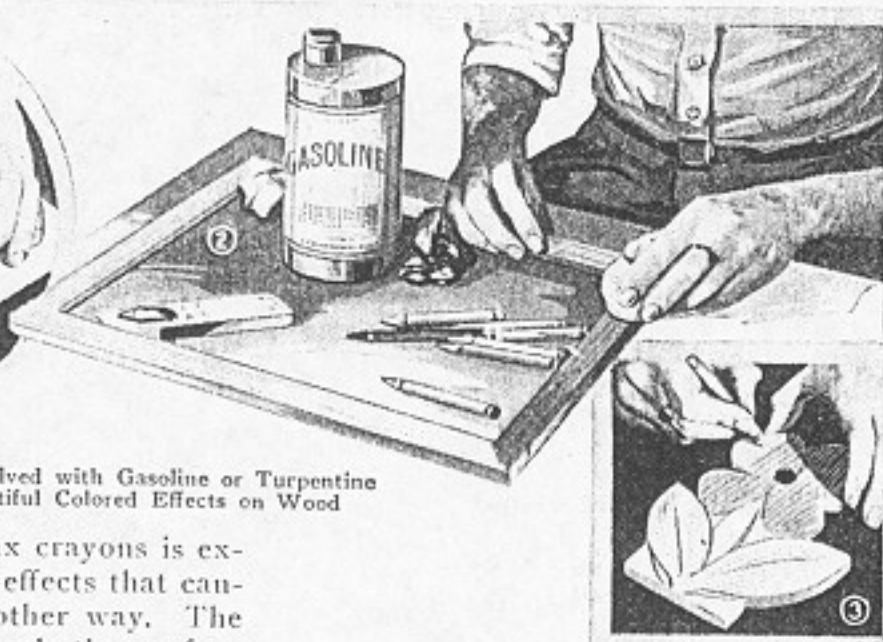
Some of the Toy Windmills Which This Man Started Building as a Hobby and Which Now Make a Living for Him

POPULAR MECHANICS August, 1931

WAX CRAYONS AND GASOLINE FOR COLOR-STAINING



Wax Crayons Softened or Dissolved with Gasoline or Turpentine Can Be Used to Make Beautiful Colored Effects on Wood



Coloring wood with wax crayons is extremely simple and gives effects that cannot be obtained in any other way. The simplest method is to wash the surface of the wood with a wad of cloth soaked in gasoline. Immediately after washing, rub the surface with whatever color you desire. The gasoline softens the colored wax, allowing part of it to penetrate the wood, much like a stain. You can obtain polychrome effects by applying patches of different colors and merging them by rubbing with a cloth, or you can wash over the colors with a gasoline-saturated cloth to remove the surface wax, leaving only that which has penetrated the wood. Then apply a coat or two of floor wax, preferably liquid, which can be rubbed to a polish. For carved book ends, letter racks and other objects, beautiful two-tone effects can be obtained as follows: Go over the tooled portions with a gaso-

line wash consisting of $\frac{1}{2}$ teaspoonful of white oil paint and $\frac{1}{8}$ teaspoonful of warm gray oil paint mixed together in a cupful of gasoline. Apply the wash with a brush. While the wash is still damp, rub the desired color of wax crayon into the background. Another method is the following: First color the wood with crayon and then rub lightly with a rag dipped in turpentine. This softens the wax so that it penetrates into the wood and at the same time removes the surplus. As no other protective coating is applied, the crayon itself produces a surface that is easily cleaned. A crayon paint can be made by cutting the crayon into small pieces, pouring turpentine over

them and warming slightly, this being done by putting the container in a hot-water bath. Stir thoroughly until mixed and apply with a rag or brush. You can produce almost any hue by mixing colors in this way. If it is desired to remove the coloring from the wood, wash with turpentine, although small spots and lines can be scraped clean with a knife. Crayons can also be used for coloring other surfaces than wood, as for instance, plaster, pottery and wall-board. When purchasing crayons, be sure to get the kind made of wax, as other kinds are not adapted to this purpose.

Popular Mechanics 1949

Easy Way to "Drill" Glass

Sometimes it's desirable to make a small hole in a pane of glass when no cutting tools are handy. In such a case, a soldering iron and length of wire solder will do the trick. Build a small dam of moist clay around the spot where you want the hole, leaving a small area of glass uncovered. Then let a drop of melted solder fall into the opening. Unless the glass is too thick, a small piece of about the right size will drop out.

